Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. 60. NEW YORK, SATURDAY, NOVEMBER 23, 1912. No. 21.

PUBLISHED WEEKLY BY

McGraw Publishing Company

JAMES H. McGRAW, Pres. C. E. WHITTLESEY, Sec'y and Treas.

239 West 39th Street, New York.

TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

CHICAGO OFFICE.....Old Colony Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
CLEVELAND OFFICE.....Schofield Building
LONDON OFFICE.....Hastings House, Norfolk St., Strand

TERMS OF SUBSCRIPTION.

Subscription price in United States, Cuba and Mexico, $3 per year. Canada, $4.50; elsewhere, $6. Foreign subscriptions may be sent to the London office.

Requests for changes of address should give the *old* as well as the new address. Date on wrapper indicates the month at the end of which subscription expires.

NOTICE TO ADVERTISERS.

Changes in advertisements should reach the New York office ten days in advance of the date of issue. New advertisements are received up to Wednesday noon of the week of issue.

Copyright, 1912, by McGRAW PUBLISHING COMPANY.
Entered at the New York Post Office as Second Class Mail Matter.

The circulation of Electrical World for 1911 *was* 965,500. *Of this issue* 17,250 *copies are printed.*

NEW YORK, SATURDAY, NOVEMBER, 23, 1912.

CONTENTS.

Editorials 1075
Supreme Court Decision in the "Bathtub" Case..... 1078
Denver & Rio Grande Electrification..... 1078
Midwinter Convention of the A.I.E.E..... 1078
Reserve Steam Station for Niagara, Lockport & Ontario Power Company 1078
Extensions to Generating Stations at Niagara Falls..... 1079
Movement for Municipal Railways in Ontario..... 1079
Graduation from Electrical Courses in the United States..... 1079
Organization of Boston Electric Motor Car Club..... 1080
First Annual Meeting of the Oregon Electrical Contractors' Association 1080
Annual Meeting of the National Association of Railway Commissioners 1080
Patent Reform Discussed at New York Jovian Luncheon..... 1081
Electric Appliance Demonstration for Clubwomen..... 1082
Hodenpyl-Hardy Men in Convention..... 1082
Court Decision in San Francisco Telephone Merger Case..... 1084
Alleged Sherman Act Violation by the American Telephone & Telegraph Company..... 1084
Public Service Commission News..... 1085
Current News and Notes..... 1087
Central-Station Practice at Halifax, N. S. 1089
The Thury System of Power Transmission by Continuous Currents. By Alfred Still..... 1093
High-Tension Distribution in Northern Illinois..... 1095
Unification in Northern Illinois..... 1096
Central-Station Design..... 1097
Carrying Capacities of Resistor Wires at High Temperatures..... 1098
Fuel Tests on Internal-Combustion Engines..... 1098
Fuel-Oil Production and Consumption in the United States..... 1098
Transmission Lines in the San Diego District..... 1099
Leased Private Operation of a Municipal Plant..... 1099
Classified Comparison of Rates..... 1100
Central-Station Activity in Kansas City..... 1100
Importance of the Small-Residence Customer..... 1101
Kentucky Electric Company's Demonstrations of Domestic Appliances 1101
Wiring for Railroad Buildings..... 1102
Recent Telephone Patents..... 1105

LETTER TO THE EDITOR:
Electric Spot Welders. By H. J. Glaubitz..... 1105
Digest of Current Electrical Literature..... 1106
Book Reviews..... 1109
New Apparatus and Appliances..... 1110
Industrial and Financial News..... 1116
Weekly Record of Electrical Patents..... 1126

THE HALIFAX CENTRAL STATION.

In another column will be found an account of the present development and the evolution of the electric supply station in Halifax, which is a combined railway, lighting and motor-service plant with a small gas equipment in addition. Like most plants of its kind, it is the result of consolidations of various organizations, in this case formed some twenty years ago. The main plant is fortunately situated on tidewater and includes a combined engine and turbine equipment, the generators being three-phase, 60-cycle machines. Use is made of Cape Breton coal, and service tests of this fuel are not without interest. The boiler equipment includes seven water-tube units delivering steam at 150 lb. pressure and 100 deg. super-temperature. The boilers are equipped with underfeed automatic stokers. A competitive test of these with the hand firing previously employed showed that with hand firing the evaporation from and at 212 deg. was barely over 7 lb. of water per lb. of coal as taken from the pile. With the automatic stokers operated alongside, the evaporation rose to 8.5 lb. After making all corrections for steam used for auxiliary purposes there proved to be a saving of a little over 14 per cent in favor of the mechanical stokers. It is to be noted in addition that the cost of spare parts in the stokers per year was found to be about one-half the cost of grate bars for hand firing. Results such as these for Cape Breton culm costing $1.40 a ton are decidedly satisfactory and speak well for the usefulness of the automatic stokers in dealing with rather low-grade fuel.

Although all the energy is generated in three-phase alternators, yet the plant must carry the city railway load and do a certain amount of direct-current motor work. For this purpose three induction motor-generators deliver direct current for the railways and a synchronous motor-generator set takes care of the direct-current motor load. The arc lighting is done by the series transformer system, five 100-lamp sets being in use for city work and an additional 50-lamp set for commercial service. The city arc lamps are of the 7.5-amp alternating-current type and are operated on an all-night and every-night schedule at the very modest price of $62.50 per lamp per year. This is the natural result of cheap fuel, although the extremely cheap culm already referred to is not systematically used and the coal purchased ordinarily costs about $2.75 per ton. The business of the company has never been aggressively pushed, but has grown steadily and rather rapidly until it represented last year more than $500,000, an extremely good showing for a city of 50,000 inhabitants. That lighting forms a relatively small part of the total load is shown by the fact that even during December with a maximum load only slightly in excess of 2000 kw the non-peak load averages about 1000 kw, the daily load-factor being very high.

TESTS OF HIGH-TENSION THREE-PHASE TRANSMISSION CABLE.

In the North American continent there exists a greater display of high-tension aerial transmission lines than is to be found in any other part of the world. The working emf rises to 150 kilovolts between conductors and the distances to hundreds of miles. The greatest development of these lines has been attained in the West, where the lines pass through sparsely settled districts. In the more densely populated regions of the Eastern States there has not been the same opportunity for long and very high-tension transmission systems. Again, in the yet more densely populated European countries it is not practicable to install such transmission lines. The social, legal and municipal conditions are such that all high-tension lines must go underground. This necessitates the use of high-tension cables.

It is not only commercially impossible at the present time to construct cables to withstand such working pressures as 150 kilovolts, but it is also expensive to use lead-covered cable as a substitute for the free air of out-of-doors, even allowing for the cost of towers and insulators. Nevertheless, great progress has been made in the construction of high-tension cable during recent years. Three substances compete for use in the insulation of such cables, namely, rubber, paper and varnished cambric. An article noticed in the *Digest* has recently been published by Mr. W. Pfannkuch, in the *Elektrotechnische Zeitschrift,* describing a series of tests on more than 200 km of armored and lead-covered paper-insulated three-phase cable, operating in the neighborhood of Berlin, at a working pressure, between wires, of 30 kilovolts and at a frequency of 50 cycles per second.

It is shown that the skin effect of the 50-cycle current increases the linear conductor resistance about 5 per cent above the normal 0.35 ohm per wire km, as measured by direct current, at 15 deg. C. Detailed measurements of the power expended in 60 km of the cable indicate that while the charging current of such a length is a considerable percentage of the rated load current, yet the dielectric loss is relatively very small, the power-factor of the charging current being only about 2 per cent, and that this represents nearly all I^2R loss. The dielectric-loss power-factor is given as only 0.3 per cent.

Some interesting oscillograms are appended to the article to show the effects of switching on the make-or-break values of voltage and current, both with and without the use of an auxiliary contact. The auxiliary contact in such a switch introduces a carborundum resistor of about 4000 ohms resistance into the circuit, just before closing or just before opening, at the main blades. This auxiliary contact greatly reduces the amount of electric splash or disturbance at discontinuity. Thus, without the aid of the auxiliary contact, the closing of the switch on 60 km of cable at no load from 30-kilovolt busbars, at the instant of peak voltage, gave rise to a surge of current in the next half-wave of about 150 per cent excess; while surges in the voltage of lesser and dwindling magnitudes can be detected in the oscillogram for several cycles of about 200 cycles per second natural frequency. This big splash of current would of course be greatly reduced if the switch happened to close near an instant of zero potential. The use of the auxiliary contact is shown to reduce the splash very markedly.

It is unfortunate that the generator used in the series of experiments developed very noteworthy harmonic ripples, so that the arithmetical analysis of the phenomenon is obscured by the effects of the harmonic currents thereby produced. Thus the charging current observed is considerably increased above what a pure sine fundamental wave of the emf might be expected to produce, but the results obtained in the tests promise very well for the life of the cable in practical service.

INTERCONNECTED DISTRIBUTING SYSTEMS.

The account of the widespread transmission and distribution of energy in northern Illinois printed elsewhere in our columns shows an existence of a situation until now rather unusual but tending to become more common. The system here described, like a German system noted in our *Digest* this week, is notably different from the ordinary energy transmission system or the ordinary distributing system found in cities and towns of moderate size. If one imagines a plant in a little rural town looked at through magic spectacles that would convert every farmhouse into a village and magnify distances, loads and voltages in a correspondingly fantastic ratio, he gets a very good idea of what plants like the one before us are actually accomplishing. They are distributing energy, not to scattered customers, but to scattered towns and groups of customers, all relatively small considering the total load on the system, distributed with some rough uniformity, as single customers in a town would be.

The transmission voltages, owing to the distances covered, must be considerably greater than in an ordinary distributing system. The problems of voltage regulation are correspondingly more troublesome, although it is interesting to note that in a general way, considering the longer transmission lines, the individual community loads are relatively so small that they act almost as a uniformly distributed load on the line. For the longer lines the comfortable and conservative emf of 33,000 volts is employed, with substantial wooden-pole construction and insulators of the simple character usual with such a voltage. A good deal of branch-line work, however, is carried out on the four-wire, three-phase system, using 2300 or 4600 volts between neutral and phase wires. This star-connected primary distribution arrangement is an exceedingly useful one for fairly great distances, being very economical of copper and requiring the use of nothing more elaborate than ordinary distribution transformers. Although wherever used this system has proved extremely convenient, yet for some strange reason its advantages have been rather generally overlooked. In fact, one may go further and say it is somewhat rare to find the very advantages of the three-phase system which were the strongest arguments in its favor in its early days made use of in every-day practice. Most so-called three-phase distribution systems consist of groupings of single-phase loops, to the considerable detriment of the regulation.

The systems as laid out now are somewhat heterogeneous in character, having resulted from the combination of small

plants, but they will ultimately be developed into closed networks giving far better security against break-down than any system not interconnected can possibly do. It has proved necessary to take considerable pains with the voltage regulation, and in all the larger communities automatic regulators are installed in the substations where such exist. Some trial is being made of small automatic regulators installed out of doors for yet lighter loads. As is pointed out in the article, the first cost of a system of this kind is necessarily somewhat high, but the consolidation of the generating stations tends to keep down running expense. The diversity-factor is probably large, and as the load builds up the business should become profitable.

ELECTRICAL ENGINEERING COLLEGE TRAINING.

In the early days of mechanical engineering it was customary for a youth aspiring to enter the profession to be apprenticed to an engineer or to an engineering firm for a term of several years. In this period of indenture he was supposed to receive instruction in engineering work by contact and service with a practitioner. A similar procedure applied in the professions of law and medicine. In those days the range and depth of professional knowledge were much more limited than at present, so that a practitioner by training one or more assistants to his practice was able to fit them for their subsequent careers in a particularly suitable and efficient manner.

The habit of acquiring a professional training by indenture has fallen into desuetude, the change commencing about a hundred years ago and taking place more rapidly in some professions than in others. Relics of the old system are still in existence under various names. The change was largely rendered necessary by the increasing depth and technicality of professional occupation and knowledge, so that a youth entering the professional arena fresh from the regular school or college was not fitted to receive the specialized instruction. The practitioner to whom he was bound rarely had the patience or spare time for drilling the newcomer in the studies preliminary to the technical work, so that the assistant might work perfunctorily in the practitioner's business for many months without properly understanding the purport of his duties. Mutual dissatisfaction resulted, and technical schools began to form, in response to the need for special technical training, between the regular schools and the professional man's office or factory.

In all engineering the period and extent of special technical training have steadily extended during the last twenty years, and the specialization still continues. The number of engineering schools has also steadily increased until at the present time there are a few more than 100 technical schools or colleges in the United States alone granting degrees in electrical engineering. Not all of the men who rise to prominence in electrical engineering pass through these schools. There always have been, and there probably always will be, men who rise in a profession by their own unaided efforts outside of the regular channels of training; but it is not too much to say that the great bulk of the men who will lead in the electrical engineering of the future, industrially, commercially and professionally, will have been graduates from our electrical engineering schools.

We present in this issue our annual census of electrical engineering students in the United States. It will be noted that with the exception of post-graduate students there has been a slight decrease in the attendance in every division and class, including the highly organized technical schools as well as the vocational schools. This tendency may be attributed in part to two noteworthy facts, namely, standardization in manufacture and increasing interest in agriculture. Service in the large manufacturing corporations is not now so inviting as in former years, while college training in agriculture promises independence in a few years. It is not too much to expect later an increase in the number of students in engineering courses, in view of the growing appreciation of the value of technical education for all kinds of business careers, both technical and non-technical.

SUPREME COURT DECISION IN THE "BATHTUB" CASE.

Although the full text of the Supreme Court decision last Monday in the so-called "Bathtub Trust" case is not yet at hand, portions of the opinion which have been reported are sufficient to indicate the probable trend of its effect on the patent situation. In brief, the decision of the lower branch of the federal court in Maryland was upheld and the defendants were found to be violating the Sherman act. The enameled-ironware trade was practically controlled from producer to consumer through license agreements involving 85 per cent of the manufacturers and 90 per cent of the jobbers. The patent under which the licenses were executed covered a tool or dredger employed to sprinkle enamel over the hot ironware, in the process of manufacture, but the restrictions under the licenses related as well to the final product and the terms and conditions of sale. Main reliance was placed by the joint defendants on the patent laws, and in particular upon the interpretation of law in the Dick case. It will be recalled that the license restrictions in reference to the mimeograph stipulated the kind of unpatended materials or supplies to be used therewith, whereas in the present case the restrictions had to do with the unpatented product, and the use or disposal of the product did not affect the operation or efficiency of the patented tool.

The "bathtub" case is therefore sharply distinguished from the Dick case, both in the sense just defined and in the further respect that the co-defendants had created a live substantial monopoly, which was in flourishing condition. The decision says in effect that the patent laws carry no immunity from the provisions of the Sherman act, but nevertheless the reports state that in the unanimous opinion of the court there is nothing in the present decision which is inconsistent with the Dick case. This sets at nought the premature conclusions already circulated in certain of the daily newspapers that the patent laws are satisfactory in their present form and need no revision. It cannot be too sharply emphasized that the situation created by the interpretation of law in the Dick case needs attention as much as it ever did, and the efforts to obtain a thorough investigation by a commission should not be suspended.

SUPREME COURT DECISION IN THE "BATHTUB" CASE.

On Nov. 18 the United States Supreme Court handed down the long-expected decision in the so-called "bathtub case," upholding the opinion of the United States District Court of Maryland. Mr. Justice McKenna read the unanimous opinion of the court, which holds as invalid the license agreements under which numerous manufacturers of sanitary enameled ironware entered into a combination to control the industry and declares that the combination was in restraint of trade and in violation of the Sherman anti-trust law. The defense that the combination was lawful in view of the license restrictions imposed in connection with a patent owned by one of the defendants on a tool employed in the manufacture of enameled ware was rejected by the higher court. This case has important features which distinguish it from the Dick case, decided last spring, particularly in the respect that an established monopoly of 90 per cent of the trade was admittedly in existence, and in the further respect that the license agreements related, not to the enameled-ware product, but to a tool or device employed in the process of manufacture. Inasmuch as the full text of this most important decision will not be available until after this issue goes to press, we shall reserve a fuller account of the case until next week.

DENVER & RIO GRANDE ELECTRIFICATION.

Following numerous conferences between representatives of the General Electric and the Denver & Rio Grande Railroad companies, the latter will shortly undertake the equipment of its mountain division between Helper, Utah, and Salt Lake City, a distance of 115 miles, for electrical operation with direct current. Contracts are to be let shortly by the railroad company for the construction of a 15-mile detour between Tucker and Soldier Summit, Utah, on this division, which will then have a maximum grade of only 2 per cent, as compared with the 4 per cent grade of the present 7-mile line between these points. Work on the new project is to be completed early in the summer of 1913. Energy for the operation of the electrified portion of the system will be furnished by the recently organized Utah Securities Corporation, through its operating subsidiary, the Utah Power & Light Company. A large part of the energy will be furnished by the Telluride Power Company, which is now a part of the Utah consolidation.

A steam auxiliary station, to have a rated output of between 30,000 kw and 40,000 kw, will probably be built near Soldier Summit for the Utah Power & Light Company, to insure a continuous supply of energy. About $4,000,000 is to be spent by the central-station interests on extensions and enlargements in connection with the project, and about $6,000,000 will be spent by the railroad company. If the initial electrification plan proves to be successful the railroad company will equip its lines to the eastward of Helper for electrical operation. When the plan was first considered the electrification of only a small portion of the division between Helper and Salt Lake City was contemplated, but when the additional economies and advantages to be derived from the operation of the entire division by electricity were demonstrated the railroad company decided to extend the electric service over the entire 115 miles of this division. Among other factors that influenced the road in its decision were the location of the division in the heart of the Utah coal and coke field, with its attractive tonnages, the large increases in passenger traffic anticipated in view of the Panama-Pacific Exhibition at San Francisco, and the increased freight business that will follow the opening of the Panama Canal.

Mr. E. L. Brown, vice-president of the Denver & Rio Grande Railroad Company, speaking of the electrification plan, stated that it is what all the railroads of the country are coming to. "We are only abreast of the times, taking the country as a whole, and somewhat ahead of them in the West. A large corps of electrical engineers will be in the field in a few days to examine into the details. In addition to the $6,000,000 we will spend, the power companies will have to spend about $4,000,000 to supply the electric power. We feel confident that the first electrically operated trunk line in this part of the mountain West will be the Rio Grande and that its trains will be in daily movement with this power by July 1 of next year."

MIDWINTER CONVENTION OF THE A. I. E. E.

Under the auspices of the standards committee, a midwinter convention of the American Institute of Electrical Engineers will be held at the New York headquarters Feb. 26 to 28. This meeting will be devoted to the general subject of the rating and testing of electrical machinery and apparatus. Members have been invited to contribute papers dealing with the following subjects: (1) Methods of determining temperature of apparatus, of room temperature, and correction of temperature rise for room temperature, humidity, barometric pressure, etc.; (2) methods of determining losses in apparatus, including: load losses, their determination and approximation; commutation or brush losses, their determination, approximation or calculation; (3) methods of testing apparatus under conditions equivalent to specified performance; (4) guarantees and permissible variations therefrom, and (5) miscellaneous subjects connected with rating and testing, such as insulation tests, high-potential test and spark-gap standard, permissible variation of wave shape of alternators, and control apparatus, rheostats, heating devices and sundry other subjects. It is the wish that these papers shall contain data and constructive criticism, with definite recommendations for the guidance of the standards committee in the revision of the "Standardization Rules," but shall avoid general theoretical investigation. The secretary asks that all who desire to contribute papers for this convention notify the chairman of the standards committee at once, and states also that all manuscripts must be received at the Institute headquarters on or before Jan. 1. Dr. A. E. Kennelly, of Harvard University, is chairman of the standards committee.

RESERVE STEAM STATION FOR NIAGARA, LOCKPORT & ONTARIO POWER COMPANY.

The Beebe Syndicate, Syracuse, N. Y., has closed a contract with the Niagara, Lockport & Ontario Power Company whereby the latter will take over the 6500-kw steam-turbine station of the Rochester, Syracuse & Eastern Railroad at Lyons, N. Y., for $600,000 and the 1300-kw power plant of the Auburn & Syracuse Electric Railroad at Auburn, N. Y., for $226,000. The Beebe Syndicate has also entered into a long-term contract with the transmission company for energy for the various railway properties controlled by it. One of the stipulations of the contract is that the Niagara, Lockport & Ontario Power Company shall keep both the Lyons and the Auburn stations in operation until the Salmon River development owned by the transmission company has been started. As is well known, Syracuse receives energy transmitted from Niagara Falls over the lines of the Niagara, Lockport & Ontario Power Company. The interruptions to this service, although less frequent than in former years, have caused the utilities in Syracuse some concern, with the result that the Niagara, Lockport & Ontario Power Com-

pany has bought the capital stock of the Salmon River Power Company, as noted in our issue of Oct. 12, and by this means secured the 15,000-hp hydroelectric development on the Salmon River now under construction some 40 miles north of Syracuse. Moreover, the business around Syracuse is such as to warrant either another line from Niagara Falls or the erection of a station near the Salt City, and the latter alternative has been chosen. The railway company, one of whose lines is already supplied with energy by the transmission company, is naturally solicitous about its service; hence the stipulation about the operation of the steam stations until a duplicate source of energy is available. The contract becomes effective Dec. 1 on the approval of the Public Service Commission of the Second District of New York.

EXTENSIONS TO GENERATING STATIONS AT NIAGARA FALLS.

All of the large generating companies on the Canadian side of Niagara Falls are at present engaged in building extensions to their systems with a view to utilizing all the water available for power purposes under the existing treaty. The Toronto Power Company has a number of new units already in place and early next year will complete its station, which will have equipment aggregating 125,000 hp. A new line fitted with pin insulators and operated at 85,000 volts will also be in operation between Niagara Falls and Toronto. The Canadian Niagara Power Company is completing its station building and installing additional units. It will expend $1,250,000 in the next two years in enlarging the forebay so as to be able to get enough water to generate all the electricity that it can dispose of under the treaty. The station of the Ontario Power Company has been doubled in size and will shortly be completed. With the installation of two 12,000-kw units now on order the company will be using almost all of the water granted to it by the Dominion government. The stations on the American side of Niagara Falls are now using all the water allotted to them by the Secretary of War, and while the granting of additional water up to the amount at the disposal of the United States under the treaty is optional with the Secretary of War, there does not appear to be any inclination on the part of the Washington officials to release any of this water for power purposes. For the present, therefore, and probably for some time to come, the stations on the American side have reached their maximum development, and no further development will be possible on either side of the falls after 1915, for by that time all the available water will be used.

MOVEMENT FOR MUNICIPAL RAILWAYS IN ONTARIO.

The Ontario Municipal Electric Association at a meeting held in Toronto Nov. 14 petitioned the provincial government to extend its public ownership policy by empowering the Hydro-Electric Power Commission of Ontario to construct electric railways throughout the province. At the meeting some thirty municipalities were represented and the Hydro-Electric Power Commission was requested to look into the advisability and practicability of constructing such a system. It was requested to report on the cost of construction and operation of roads following the transmission lines of the commission in the Niagara power zone and extending throughout western Ontario and the Highland district. An estimate of the probable revenue was also asked for by the association.

GRADUATION FROM ELECTRICAL COURSES IN THE UNITED STATES.

During the past six years the *Electrical World* has published statistics relating to the students in and graduates from schools in the United States conducting systematic courses in electrical engineering. The earlier compilations appeared in our issues dated July 27, 1907; Dec. 26, 1908; Feb. 10, 1910; Dec. 22, 1910, and Nov. 11, 1911. Below are given the data compiled from our sixth annual census of these schools, together with certain data from the fifth census presented herewith for comparative purposes.

TABLE I.—ELECTRICAL ENGINEERING STUDENTS AND GRADUATES.

	Number of Schools.	Students 1911–12.	Graduates 1912.	Total Graduates to June, 1912.
Class I.....	25	3433	617	9,333
Class II.....	70	4079	607	6,211
Class III.....	18	1409	272	2,774
Totals.....	113	8921	1496	18,318

As indicated in Table I, the schools have been grouped into three separate classes. Class I includes the schools of highest standing, the degrees from which confer more or less prestige on the graduate. Class III includes those schools in which the instruction is quite elementary but which have regularly organized courses in electrical engineering. All other recognized schools giving complete courses of instruction in electrical engineering are included in Class II. During the past year there has been no change in the number of schools listed in Class I; there has been an addition of one to Class II and of three to Class III.

TABLE II.—COMPARISON OF STATISTICS FOR SIX YEARS.

Year:	1907.	1908.	1909.	1910.	1911.	1912.
Number of students.....	8929	9651	8670	9041	9515	8921
Number of graduates.....	1358	1501	1473	1545	1614	1496

TABLE III.—STATISTICS OF POST-GRADUATE AND UNDERGRADUATE STUDENTS IN 1911 AND 1912.

Year.	Class.	Freshmen.	Sophomores.	Juniors.	Seniors.	Post-graduates.	Total Students.	Graduates.	Total Graduates.
1911	First	1174	912	853	670	112	3721	633	8717
	Second	1552	1105	832	743	40	4272	682	5604
	Third	524	405	327	252	14	1522	299	2502
Grand	totals...	3250	2422	2012	1665	166	9515	1614	16823
1912	First	1113	866	728	604	122	3433	616	9333
	Second	1538	1034	775	685	47	4079	607	6211
	Third	522	378	267	221	21	1409	272	2774
Grand	totals..	3173	2278	1770	1510	190	8921	1495	18318

The total number of students recorded includes not only those taking the regular four-year course, but also short-course men and certain others taking post-graduate work. The fifth census showed 166 post-graduate students candidates for an engineering, master's or doctor's degree; the present census shows a total of 190 in this group. A comparison of the statistics for 1912 with those for 1911 will show only a slight change in numbers of students of the several classes, the change in each case representing a decrease. It is to be noted that a similar and even more

marked decrease took place between the years 1908 and 1909. It is rather remarkable that from 1907 to 1912 the number of students has been practically constant at about 9000, with an average of about 1500 graduates per year.

An examination of statistics obtained from a large number of sources indicates that approximately one-half of the students who enter the freshman class become graduates of the four-year engineering courses. With a total of 18,318 graduates to date, it is probable that about 37,000 students entered the freshman class and received instruction for from one to three years. These men have profited by their training at least in proportion to the time spent in study, and many of them have become prominent in the industry.

A large portion of the engineering graduates undertake what is to them post-graduate work along practical lines by becoming apprentices in electrical manufacturing establishments. For this training the manufacturers select only those graduates who give promise of future usefulness to the establishments. Not all technical graduates continue in strictly engineering work, many entering business life, in which their technical training proves particularly useful. This fact was well brought out in an address before the engineering classes of Washington University by Mr. W. A. Layman, president and general manager of the Wagner Electric Manufacturing Company, who said: "Technically trained men are coming rapidly into executive positions because they have been trained to mental processes which are clear-cut, free from sentimental bias and directed toward strictly truthful results. They have also an accurate knowledge of fundamental scientific and physical facts and a capacity for both synthesis and analysis."

ORGANIZATION OF BOSTON ELECTRIC MOTOR CAR CLUB.

At a meeting of the Electric Vehicle Club of Boston on Nov. 14 a reorganization was effected under the name of the Electric Motor Car Club of Boston. President Day Baker occupied the chair, and the formal business included the adoption of a constitution and by-laws governing the new association of electric automobile and central-station interests whose work under the old name has been a conspicuous feature of the electric truck and pleasure car campaign in eastern New England during the past eighteen months. The club is now on a self-supporting basis, and according to present plans meetings will be held fortnightly to further the co-operative development of the New England field from the standpoint of the electric automobile. The annual membership dues are $10 for electric-vehicle dealers and others profiting directly from the sale of storage-battery trucks and pleasure cars, and $2 for owners of machines of the electric type who may be interested in the work of the organization. The annual meeting and election of officers will be held in October.

A feature of the meeting was a general discussion of the electric automobile situation at Boston. Mr. W. H. Atkins, general superintendent of the Boston Edison company, touched upon plans for popular lectures to be given under its auspices during the coming winter, stating that these will probably include illustrated talks upon the electric truck and pleasure car. Efforts will be made at some of the lectures to mobilize representative electric vehicles on the spot, in order still further to popularize the subject. The lectures will be given before local boards of trade, church and social organizations. Mr. P. E. Whiting announced that a new charging station capable of handling the largest machines is about to be installed by the Cambridge Electric Light Company near Harvard Square. The meeting closed with a short talk by Mr. John A. Voodry, Boston, on "Salesmanship as Applied to Electric Automobiles."

FIRST ANNUAL MEETING OF THE OREGON ELECTRICAL CONTRACTORS' ASSOCIATION.

The first annual convention of the Oregon Electrical Contractors' Association will be held at Portland on Dec. 17 and 18, with headquarters at Moose Hall, Seventh and Morrison Streets. Following the address of welcome, which will be responded to by Mr. J. H. Ralston, of Albany, the president of the association, on Tuesday, Dec. 17, the following papers will be presented: "The Relation of the Oregon Contractor to the Underwriters' Inspection Work in Oregon," by Mr. F. D. Weber, inspector of the Underwriters' Equitable Rating Bureau; "The Relation of the Electrical Jobber to the Electrical Contractor," by Mr. F. N. Averill, manager of the Fobes Supply Company, Portland; "What the National Electrical Contractors' Association Is Doing for the Electrical Contractor," by Mr. George H. Duffield, special representative of the N. E. C. A.; "Some Practical Statements from a Central-Station Expert," by Mr. O. B. Coldwell, general superintendent of the light and power department of the Portland Railway, Light & Power Company; "Municipal Inspection," by Mr. Howard Joslyn, city electrician, Seattle, Wash.; "Credit, Its Utility in the Modern Commercial World," by Mr. L. B. Smith, manager credit department Fleischner-Mayer Company, Portland, and "Costs and Efficiency," by Mr. P. L. Proctor, manager Pacific Audit Company. After luncheon visits will be made to the various jobbing houses of Portland, and in the evening the members and guests will attend the theater. For Wednesday morning, Dec. 18, a trip is planned to the Portland Railway, Light & Power Company's plant at Cazadero, and luncheon will be served at the Estacada Hotel. An entertainment and banquet during the evening of Dec. 18, at the Multnomah Hotel, will conclude the program.

The officers of the association are: President, Mr. Joseph H. Ralston, Albany; vice-president, Mr. W. O. Fouch, Portland; secretary, Mr. J. E. Kilkenny, St. John's; treasurer, Mr. John R. Tomlinson, Portland. This is the first event of its kind to take place in Oregon, and it has met with considerable interest and enthusiasm on the part of electrical contractors and others connected with electrical affairs. The Oregon association is affiliated with the National Electrical Contractors' Association.

ANNUAL MEETING OF THE NATIONAL ASSOCIATION OF RAILWAY COMMISSIONERS.

On Nov. 19 the National Association of Railway Commissioners opened its twenty-fourth annual convention at Washington, D. C., at which forty-three states were represented. The sessions will continue for four days. Chairman Charles A. Prouty, of the Interstate Commerce Commission, delivered the opening address, dealing with the responsibility of those who have to do with the regulation of railroads and other common carriers.

The address of President C. F. Staples, a member of the Railroad and Warehouse Commission of Minnesota, covered many phases of the regulation of common carriers and public utilities. He dwelt, among other points, upon the great importance of co-operation in committee work and urged the commissioners to look upon committee duties with a sense of responsibility. Among the special topics considered by the speaker were the weighing of freight, car supply, safety of operation and the rearrangement of committees. Consideration was also asked of the proposal to change the name of the association, in view of the fact that so many of the commissions have jurisdiction over public utilities in addition to steam railroads. The need of revising the constitution was also brought to the attention

of the members, and the suggestion was presented to extend the membership so as to embrace assistant secretaries, statisticians and engineers of state commissions, who are capable of doing very effective committee work.

A further account of the meeting, including abstracts of some of the papers and discussions, will be presented in a later issue.

SELLERS OF GAS AND ELECTRIC VEHICLES URGED TO CO-OPERATE.

Mr. Henry Farrington, editor of *The Power Wagon*, presented an outspoken paper, entitled "Let Us All Co-operate to Compete Against the Horse," at the meeting of the Chicago Section of the Electric Vehicle Association on Nov. 19. The writer commented on the lack of co-operation among the motor-truck salesmen and said that the question of type should not enter into the early negotiations with the customer. He said that the time to quarrel over engineering may come when the horse is no longer in the ascendency. In the opinion of the author it is absurd for electric men to invite a class war with gas-machine men, as the latter have the superiority in number, money and resources. Co-operation with the Chicago Automobile Trades Association was urged, and it was suggested that the efforts of the electric men be directed against the horse and not against the gas wagon.

Mr. Farrington also made the interesting suggestion that electric commercial vehicles should be sold without batteries and that there should be large operating establishments for delivery wagons and trucks where the battery will be placed in the vehicle and maintained on some monthly charge, say on a mileage basis.

In the discussion Mr. W. J. McDowell, of the General Vehicle Company, advocated co-operation with the motor-truck section of the Chicago Automobile Trades Association, and also co-operation in publicity.

Mr. W. H. Metcalf, of Philadelphia, told of the experiences of the automobile trade association in that city. The total membership is 187 and there is a special "truck lunch" held every Wednesday. Prominent buyers are invited to address these noonday meetings. There is probably less "knocking" and price cutting in the motor-vehicle business in Philadelphia than in any other large city.

Mr. George Harvey Jones, chairman of the Chicago Section, commented on the fact that in the national advertising campaign of the Electric Vehicle Association of America there is not a line directed against the gasoline machine. This is also the case with the advertising of the Commonwealth Edison Company. The speaker said that he believed there is room for each type of truck.

Several speakers referred to Mr. Farrington's idea of selling commercial electric vehicles without batteries. Nearly all agreed that the idea was a good one and would prolong the life of the battery. However, the industry may not be ready for this change at the present time. Mr. H. J. Murphy, a garage man, pointed out that a large amount of capital would be required for such an electric-vehicle operating establishment and that the proposition was too big for the average garage. Mr. Ernest Lunn, of the Walker Vehicle Company, thought that the transfer of the battery from one rig to another might cause some confusion. An equitable rate for charging should be based rather on ampere-hours than on miles traveled. Mr. Jones said that the plan of selling vehicles without batteries did not necessarily imply that, in service, batteries were to be transferred from one vehicle to another. The essence of the idea is simply to take the price of the battery out of the investment cost for electric vehicles and put it into the maintenance cost. Others taking part in the discussion were Messrs. A. A. Gray, of Chicago; C. I. Weaver, of Detroit, and D. C. Arlington, of Chicago.

FAILURE OF OLYMPIC POWER COMPANY'S PLANT.

According to newspaper reports, the dam of the Olympic Power Company in the Etwha River, about 7 miles from Port Angeles, Wash., failed to the extent of allowing the river to pass under it about Oct. 31. The dam, which is said to be intact, is of peculiar construction, being fastened into the rock at the sides of a narrow gorge and supported like a bridge. It appears that the water washed beneath it, but authentic information as to the exact cause of the accident is difficult to obtain. The dam was about 100 ft. high and of equal width at the crest, narrowing to a lesser width at the base. The nearby power station is equipped with two 3000-kva generators, and the company plans to deliver electricity to Port Angeles, Port Townsend and the Bremerton Navy Yard, the system embracing a transmission at 66,000 volts for a distance of nearly 100 miles.

PATENT REFORM DISCUSSED AT NEW YORK JOVIAN LUNCHEON.

At the regular bi-weekly Jovian luncheon held in New York on Nov. 20, at the Hotel Imperial, with an attendance of 107, the speaker of the day was Mr. Ralph D. Mershon, president of the American Institute of Electrical Engineers and the Inventors' Guild. Mr. Mershon's subject was "Patent Reform," and he placed particular emphasis upon the desirability of securing a national commission to investigate the question thoroughly. He expressed the hope that the Jovian Order would interest itself in this subject and lend support to the commission movement. The definition of a patent was carefully considered by the speaker, who declared that it is virtually a contract between an inventor and the people of the United States, which stipulates, in substance, that in return for creating something new and making a public disclosure thereof the inventor may enjoy the exclusive right to his invention for a term of seventeen years. He also pointed out, however, that in case an inventor keeps his discovery a secret some one else who subsequently invents the same thing may obtain a patent on it and enjoin the original inventor from its use.

Patents, said Mr. Mershon, affect us all in some way, either directly or indirectly, and have been largely responsible for our unparalleled industrial development. Because of the defects and abuses of the present system it is unfortunately impossible for an inventor to obtain the privileges and protection which the framers of the patent statute originally intended. There are to-day, said the speaker, some things which are and long have been the property of the public but are not exploited because they cannot be patented and adequately protected so as to insure the promoters a final profit. Mr. Mershon said that in his own case he had expended more in obtaining and protecting patents for his inventions than he had derived from them.

There had been much criticism of our present patent system, some but not all of which, in the speaker's estimation, was warranted. Few persons, he said, agree on what specific remedies are needed. Some agree that the organic law needs no revision, but a good many others hold the opposing view. What is most needed, continued Mr. Mershon, is the appointment of a national commission of mixed character and highest standing to make a thorough and exhaustive investigation of the entire patent system, including the fundamental law, the administration of the law in the courts, practice before the Patent Office and the general administration of the office.

The speaker quoted at length from his letter of May 24, addressed to Mr. Robert L. Jaynes, past-Jupiter of the Jovian Order, in reference to patent reform. Therein he recommended that the order encourage the plan for a com-

mission and called attention to some of the more prominent defects in the present system, as follows: Numerous abuses arise from the fact that there are nine federal circuits having jurisdiction in as many sections of the country. It is possible for an infringer who is enjoined from making a certain patented article by the court in any particular circuit to move his business to some point within the jurisdiction of another circuit and there compel the patentee to have the action for infringement completely retried, and this performance may be repeated nine times, to the obvious detriment of the rightful inventor's interests and his purse. After winning an infringement case, moreover, the patentee has difficulty in recovering anything more than the royalties to which he was rightfully entitled, and must commence a separate civil action to obtain damages. Still other difficulties arise from the inadequate search sometimes made through the Patent Office files in connection with new applications, and consequently the issue of invalid patents is not an impossibility. After some particular invention has been patented and a profitable business established thereon, it is possible, in case another claimant for the invention makes an appearance and proves that he was the original inventor, to wipe out entirely the established business of the first patentee. The valuable contents of the Patent Office are, furthermore, in constant likelihood of destruction by fire, owing to the inflammable character of the buildings which contain the records. Notwithstanding the fact that the patent system has accumulated a net surplus of more than $7,000,000, Congress has failed to make any adequate provision for fireproof buildings.

In the closing portion of his remarks the speaker referred to the complex nature of the situation and the need for an exhaustive study. The Inventors' Guild, he stated, is unanimous on only one proposition, namely, the appointment of a national commission of diversified character and high standing to report to Congress on needed legislation. He declared that President Taft's message to Congress recommending such a commission was in part the result of the agitation of the subject by the Guild. He made it particularly clear that all central-station companies are interested in this question, because of the fact that so much central-station energy is sold to industrial and manufacturing concerns, whose prosperity has been fostered in a great degree by the existing patent system, and any attack upon the system of an ill-advised nature or by persons not competent to pass upon the problems at issue would unquestionably react upon the central-station industry in a harmful manner. Mr. Mershon referred briefly to some of the features of the Dick case and urged the members of the Jovian Order to consider most seriously the matter of lending their support to the movement for the appointment of a commission.

Statesman Joseph F. Becker, who presided at the meeting, announced that after the members of the order had taken sufficient time to reflect upon the substance of Mr. Mershon's address he would consider the appointment of a committee to take some definite action along the general lines proposed, if that should prove to be the wish of the majority.

Mr. T. I. Jones spoke briefly and emphasized the point that the Jovian Order has reached a stage where it can be a real force in the industry and the community. He suggested specifically the appointment of a committee on legislation.

After a vote of thanks was tendered to the speaker of the day it was announced that the next luncheon would be held on Dec. 4 at the same place and that the speaker would be Mr. William H. Merrill, manager of the Underwriters' Laboratories, Chicago, who will address the gathering on the subject of "Fire Inspection and Fire Hazard." A rejuvenation will be held on Dec. 16 at Healy's Restaurant, Sixty-sixth Street and Columbus Avenue, New York City, and about thirty candidates have already filed their applications.

ELECTRIC APPLIANCE DEMONSTRATION FOR CLUBWOMEN.

A somewhat unique and elaborate demonstration of the many uses and merits of electric appliances for household use was given by the Public Service Electric Company of New Jersey in the auditorium of its new Jersey City headquarters on the afternoon of Nov. 18. The members of the Jersey City Women's Club were the guests of the company on the occasion. The latter indicated the practical co-operation that is possible between an electric company and the public. The club, in the course of its study of household economics this winter, had asked the company to make a demonstration, and as a result of the great attention that had been given in the preparation of the program and all details the affair was exceedingly enjoyable and educational.

After a few piano selections had been rendered Mr. F. W. Schmidt, manager of the electric company's Hudson division, made a short address of welcome, which was followed by the moving-picture film, "The Education of Mr. and Mrs. Thrifty," that was shown on some of the special trains on the way to the Seattle Convention of the National Electric Light Association last June. This portrayed the trying experiences of a young couple with hand-operated household appliances and contrasted these inconveniences with the ease and comfort won by the housewife through the use of electrically operated appliances.

Mr. T. F. Bludworth, Jr., general agent of the new-business department of the Hudson division, then read a paper that covered in a simple, non-technical, yet highly interesting way the history of electric lighting and electric appliances, the principles and advantages of various kinds of lamps and appliances, and also the simplicity of wiring houses for electric service. During these remarks the company's appliance demonstrator prepared with electric appliances in one corner of the room, in view of all present, a six-course dinner sufficient for four people. The use of the electric stove for cooking joints, vegetables, etc., and of the chafing dish, percolator, etc., formed part of this practical demonstration.

Another film, "Every Husband's Opportunity," followed Mr. Bludworth's paper, and showed various applications of electrically operated utensils. After refreshments had been served the guests were taken on an inspection tour of the building, the greater part of which is given over to a most elaborate and comprehensive display of gas and electric appliances for all household and industrial uses.

HODENPYL-HARDY MEN IN CONVENTION.

About 100 of the operating officers of the subsidiary companies of the Commonwealth Power, Railway & Light Company, of Jackson, Mich., and the Union Railway, Gas & Electric Company, of New York, and other properties managed by Hodenpyl, Hardy & Company, of New York, gathered in the annual Hodenpyl-Hardy convention, which was held at the Hotel Sherman, Chicago, on Nov. 18-21. Mr. Robert Davey, secretary of the Commonwealth Power Company, of Jackson, Mich., acted as chairman and Mr. S. E. Wolff, of Hodenpyl, Hardy & Company, New York, as secretary. A number of papers were read and committee reports presented relating to a wide range of subjects having to do with managerial policies and the conditions and methods of operation encountered in the aggregation of public-utility companies represented. A dinner was given at the hotel on the evening of Nov. 20.

The list of operating companies represented at the convention is as follows: Jackson (Mich.) Gas Company, Kalamazoo (Mich.) Gas Company, Pontiac (Mich.) Light Company, Saginaw (Mich.) City Gas Company, Flint (Mich.) Gas Company, Bay City (Mich.) Gas Com-

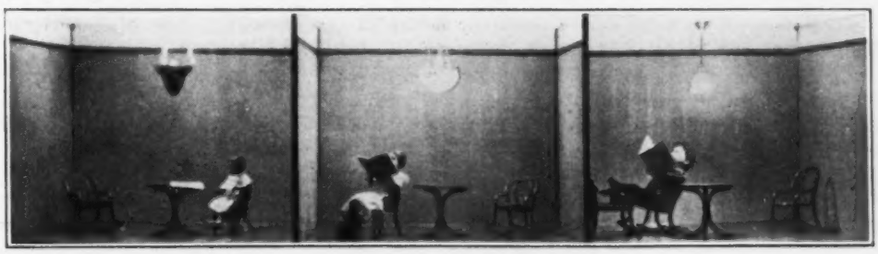
pany, Evansville (Ind.) Gas & Electric Company, Springfield (Ill.) Gas Light Company, Peoria (Ill.) Gas & Electric Company, Pekin (Ill.) Light, Heat & Power Company, Commonwealth Power Company, Jackson, Mich.; Consumers' Power Company of Michigan, Owosso, Mich.; Grand Rapids-Muskegon (Mich.) Power Company, Flint (Mich.) Electric Company, Cadillac (Mich.) Water & Light Company, Saginaw (Mich.) Power Company, Bay City (Mich.) Power Company, Pontiac (Mich.) Power Company, Springfield (Ill.) Light, Heat & Power Company, Springfield (Ohio) Light, Heat & Power Company, Citizens' Gas & Electric Company, Pekin, Ill.; DeKalb-Sycamore (Ill.) Electric Company, Washington (Ill.) Light & Power Company, Rockford & Interurban Railway Company, Rockford, Ill.; Rockford City Traction Company, Rockford, Ill.; Janesville (Wis.) Traction Company, DeKalb-Sycamore & Interurban Railway Company, DeKalb, Ill.; Springfield (Ill.) Consolidated Railway Company, Public Utilities Company, Evansville, Ind.; Saginaw-Bay City (Mich.) Railway Company, Saginaw & Flint (Mich.) Railway, Grand Rapids (Mich.) Street Railway Company, Michigan Central Traction Company, Jackson, Mich.

DEMONSTRATION OF LIGHTING EFFECTS.

At the joint meeting of the Illuminating Engineering Society and the New York Companies' Section of the National Electric Light Association held in the Edison Auditorium on Nov. 18 a paper was presented by Mr. Preston S. Millar dealing with the characteristics of the various types of lighting units. For the purpose of demonstrating the effects described use was made of a three-room house in miniature, each room being about 4 ft. square and 3.5 ft. high, the intention being to represent an average-size living room to about one-third scale. The rooms were provided with various colors of walls and ceilings and equipped with different systems of lighting, such as direct, semi-direct and indirect. With an effectiveness which words alone could not possibly produce, the author demonstrated the bad effect of glare and the desirable results obtained from proper lighting distribution and direction. One of the most striking illustrations was that relating to glare from glazed paper, which was compared with paper having a matte surface.

Discussion.

In opening the discussion, Dr. H. E. Ives called attention to the value of the demonstration from the point of view of education in good lighting principles. He stated his belief that it would be preferable to obtain light from the side rather than from overhead on account of the fact that daylight is usually received from the former direction.



Demonstration of Lighting Effects.

Dr. C. H. Sharp described a system of lighting in accordance with which artificial light would be received at night from the same direction as in the daytime. A row of lamps in trough reflectors would surround the window frame, the reflectors being placed so as to throw the light outward. At night white shades would be drawn across the windows to reflect into the room the light directed upon them by the reflectors. These shades would act as a secondary source of light, the direction of the light rays being the same as during the daytime.

Mr. L. B. Marks stated that the fact that our buildings must be so constructed that light during the daytime is received from the side should not be used as a conclusive argument in favor of this method of lighting. In fact, it is much better to have the light come from overhead than along the sides, and much more pleasing effects from a decorative point of view can be obtained when the light is from this direction.

Mr. D. McFarland Moore claimed that the prime requisite is low brilliancy of the lighting source, thus involving a large surface such as can easily be obtained with tube lamps.

Dr. A. S. McAllister called attention to the undesirable presence of light sources in the field of view when the light is received from the side, and agreed with Mr. Marks as to the advantages of light received from above.

Mr. C. A. Littlefield remarked that the demonstration made by Mr. Millar should be presented before the general public as well as before those familiar with lighting principles.

Mr. Norman Macbeth claimed that the Society for Electrical Development could not undertake a more important work than that of paying the expense of presenting such a demonstration to the general public throughout the country.

Mr. F. F. Fowle urged that the members assembled give expression to their belief that the demonstration by Mr. Millar should be seen by the largest possible number of persons for the educational effect upon the general public.

POST-OFFICE MAIL-CASE LIGHTING.

At the meeting of the Chicago Section, Illuminating Engineering Society, on Nov. 13, a paper on "Post-Office Mail-Case Lighting," prepared by Mr. W. A. Richardson, chief electrician of the Federal Building, Chicago, was read in the author's absence by Mr. E. B. Gray, of the Holophane Works, General Electric Company.

The Chicago Post Office building, according to the author, furnishes offices and workrooms for over 5000 employees and has a working floor space of 800,000 sq. ft. It was originally wired for 20,000 16-cp lamps, but owing to alterations and improvements the number has been reduced to 14,000 units. All electricity used is purchased from the Commonwealth Edison Company. Despite the twenty-four-hour service furnished in the workrooms the lighting of the building consumes only 1.13 kw-hr. per square foot of floor area per year, about one-fifth the consumption in other government buildings of a similar kind. In large part this record of economy is attributed by Mr. Richardson to the use of 5-watt series tungsten lamps on all mail and distribution cases, many of which are in service twenty-four hours per day.

Ten 5-watt series tungsten lamps spaced at 24-in centers are mounted in rigid fixtures screwed to the cases and adjusted to keep all light out of the line of vision of employees at the front. The special "burned-out-lamp-finding" sockets used are fitted with Holophane D'Olier steel reflectors, giving 4 to 6 ft.-candles on the working plane, depending on the height of case, spacing, etc. The average life of these 5-watt lamps has been found to be 2200 hours, although many lamps give serviceable life up to 8000 hours. All mail cases are joined by separable trailer connections, so

that at short notice all cases, except the master case which conveys the feeders from the floor, can be moved or shifted about the building. The Post Office Department moves all furniture and cases about once in six months, so that the case connections are important labor-saving devices.

In order to avoid unsightly drop cords and feed wires hanging from overhead, only units for general illumination are placed on the ceiling, all feeders, case lamps, etc., being supplied from floor outlets. As all floors are of cement, covered with hard wood, it was found a difficult task to rip up floors and channel the cement when a new feed was desired and no floor box was in the immediate vicinity. By the use of a specially devised electric floor-grooving machine, a 5/8-in. groove is now cut in the hard-wood floor, a lead cable laid therein and an oak strip glued and toe-nailed into place, connecting the new outlet to the nearest floor box by a special soldered water-tight fitting. This method of running branch circuits from floor feeder boxes already in place in a cement floor has saved many dollars in labor.

Postal distributers must perform their work with accuracy and rapidity and good light is a necessity. The illumination for cases described has been found ideal from both

Distributing Racks in Chicago Post Office, Showing Contrast in Lighting by Series Tungsten and by Carbon Lamps.

the economical and the illuminating standpoints, for a series of ten 5-watt lamps consuming 50 watts usually displaced old fixtures requiring from 100 to 300 watts, at the same time increasing the effective illumination 100 per cent. With the new method of illuminating mail cases eye strain is eliminated to a very great extent. Moreover, with the better system of illumination afforded the efficiency of the employees has been materially increased.

All newspaper cases are now fitted with racks made of conduit and condulets, four 15-watt lamps being arranged on a three-man case. These cases are crescent in shape and the lamps and reflectors are placed 2 ft. apart. By the use of a 15-deg.-angle Holophane D'Olier reflector the light is shaded from the distributers' eyes and is thrown on the mail bags attached to the cases. These cases are now consuming 60 watts each, whereas formerly they used four 60-watt carbon lamps, or 240 watts.

General illumination is finished by 100-watt single-controlled units equally distributed throughout the workrooms. The lamps are fitted with 18-in. white enamel reflectors and are suspended 15 ft. from the floor by window cord, with canopy, etc., so that they closely resemble fixtures in appearance.

Among those who took part in the discussion of the paper were Messrs. S. E. Church, F. G. Vaughn, M. G. Lloyd, J. W. Foster and H. H. Magdsick.

COURT DECISION IN SAN FRANCISCO TELEPHONE MERGER CASE.

The Superior Court in San Francisco has decided against the city and county of San Francisco in the suit brought to set aside the sale of the Home Telephone Company to the Pacific (Bell) Telephone & Telegraph Company, Judge Ellison held that the provision in the Home company's franchise forbidding sale or transfer of the property is null and upheld the company's demurrer. His opinion is given here in part:

"I find nothing in the provisions of the charter of the city or county of San Francisco that either expressly or by inference confers upon the city the power to place in the franchise the provision that the grantee thereof should not sell or dispose of its property. No law of the State conferred such power and the condition is clearly against the policy of the State, as expressed in its statutes granting to telephone companies the power to sell their property.

"If A should make a valid contract on good consideration with B that he would not sell his mercantile business to any one but B or with his consent, and A should, notwithstanding said contract, sell his mercantile business to C, I apprehend no court would hold that B could follow the property into the possession of C and ask of the court that it retransfer the same to B. He might have some kind of an action against A, who had broken his contract, but the contract would certainly not follow the property in the hands of the vendee, or affect the validity of the sale."

This decision is of wide purport as many California corporations hold franchises containing similar clauses prohibiting sale of the franchises.

ALLEGED SHERMAN ACT VIOLATION BY AMERICAN TELEPHONE & TELEGRAPH COMPANY.

Three months ago reports were current in the daily press throughout the country that the federal Department of Justice would institute proceedings against the American Telephone & Telegraph Company under the Sherman anti-trust law to compel its dissolution, as in the oil and tobacco cases. These rumors were promptly denied by President Theodore N. Vail, who stated in substance that he did not believe any such suit would be filed and that the company had made it a point to keep within the law to the very best of its ability. He furthermore pointed out that in the matter of acquiring independent companies the approval of the state authorities having jurisdiction had been obtained in each case, and that if any ground whatever existed for suit by the government it was due to mistaken interpretation of the law, under the best advice, and not to any intent or desire to circumvent it. Mr. Vail also said that the Department of Justice had not communicated with the company in reference to the matter, as might be expected if the reports were true.

Attorney General Wickersham stated to a representative of the *Electrical World* this week that he had notified counsel for the telephone company that in his judgment certain of its policies and methods of doing business are in violation of the anti-trust law and that unless changes are made so as to conform its business with that law he would find it necessary to bring suit for dissolution under the Sherman act. According to information obtained from reliable sources Mr. Wickersham has had conferences with representatives of the company, and they have agreed to make the changes suggested. Therefore he regards it as unlikely that any necessity for bringing suit will arise. The department undoubtedly desires to give every reasonable protection to the independent telephone companies which they can ask, but at the same time Mr. Wickersham hopes to

have his order complied with and the necessity of a prosecution thus avoided.

No details of the order are obtainable at this time, either from the company or the Department of Justice, and it is not likely that anything will be made public immediately. It may be recalled, in this connection, that the American company is both a holding and an operating organization. The local Bell service is in the hands of various subsidiary operating companies covering the United States and Canada, nearly all of which are controlled by the parent company. These companies also furnish toll service within their territories and afford terminal service to the long-distance system. The latter is retained and operated by the parent organization, representing the extent to which it is an operating company. The American company's principal investment, by large part, is in the securities of its subsidiary companies. There was considerable reason for believing, about a year or more ago, that the long-distance system would be subdivided and distributed among the several groups of local operating companies, in the interests of economy. This plan would have left the parent organization a pure holding company, a fact which may or may not have caused the idea to be abandoned, but for the present, at least, it seems to have been given up.

As a whole the Bell companies have been rapidly absorbing the independent companies, or establishing physical connections under one or another form of traffic agreement. In some instances the Bell interests have taken over independent plants in their entirety, while in others the independent company has taken over the local Bell plant and made a traffic agreement for the interchange of business across territorial boundaries. Arrangements of the latter sort have been more prevalent in rural districts than large urban communities. Bell control and direction of the Western Union Telegraph Company, leaving but a single large rival in the communication field—the Mackay interests controlling the Postal Telegraph and Commercial Cable systems—has undoubtedly some bearing also on the present status of the case. Future developments in this unusual situation will be awaited with special interest, for it seems unlikely that the Department of Justice will not eventually take the public into its confidence in so important a matter, even if the order is amicably complied with, as now seems probable.

PUBLIC SERVICE COMMISSION NEWS.

NEW YORK COMMISSION, FIRST DISTRICT.

The Appellate Division of the Supreme Court, First Department, in a decision handed down Nov. 15 upholds the order of the Public Service Commission for the First District directing the Bridge Operating Company to reduce the local car fares over the Williamsburg Bridge from 3 cents to 2 cents for one-way trips, or from two tickets for 5 cents to three trickets for 5 cents. The judges of the Appellate Division were unanimous in their decision which dismissed the writ of certiorari obtained by the company for a review of the commission's action. Unless further appeal is taken this will bring about the reduction of the bridge fares, and will result in a saving of from $80,000 to $90,000 a year to the traveling public using the Williamsburg Bridge cars.

Commissioner Maltbie of the Public Service Commission found that the company was making a profit of more than 100 per cent upon its authorized capital, or more than 200 per cent upon the present value of the property.

The total number of revenue passengers carried by the Bridge Operating Company is between 9,000,000 and 10,000,000 a year, and the average fare per passenger during the year ended June 30, 1911, was 2.53 cents.

At the instance of Commissioner J. Sergeant Cram, the commission has instructed its counsel to draft a bill for presentation to the next Legislature amending the Public Service Commissions law by including within the First District all that portion of Long Island lying outside the city of New York and comprising Nassau and Suffolk Counties. At present this part of Long Island is under the jurisdiction of the Commission for the Second District, with headquarters at Albany, while the western part of Long Island, embraced with the New York City limits, is under the jurisdiction of the First District Commission.

Reports of gas and electric meter tests for October show that 37,949 gas meters were tested during the month. Of this number 266 were tested on complaint, and of these 97, or 36.5 per cent, were found fast; 52, or 19.6 per cent, slow, and 117, or 43.9 per cent, within the limits of accuracy as defined by law. Thirty electric meters were tested on complaint, of which 4, or 13.3 per cent, were found fast, none was found slow, and 26 were within the limits of accuracy as defined by law.

NEW YORK COMMISSION, SECOND DISTRICT.

The Salmon River Power Company, which recently came under the control of the Niagara, Lockport & Ontario Power Company, has filed ten petitions with the commission. Three of these request authority to acquire and exercise franchises which the Pulaski Electric Light Company holds for electrical distribution in the towns of Richland, Orwell and Albion, Oswego County. This company also asks for the approval of exercise of franchises for electrical distribution in the towns of Parish and Hastings and villages of Altmar and Central Square, Oswego County, and in the towns of Cicero, Clay and Salina, Onondaga County. It is stated that the Salmon River company is now engaged in the construction of a hydroelectric plant on Salmon River in the town of Orwell, with transmission lines from its power house to the village of Solvay, Onondaga County, where they will connect with transmission lines of the Niagara, Lockport & Ontario Power Company. This company is the successor of the Oswego County Light & Power Company, and some of the franchises sought to be exercised were issued to its predecessor.

MASSACHUSETTS COMMISSION.

Hearings were concluded at Boston on Nov. 16 by the Gas and Electric Light Commission upon the legislative resolve requiring the board to investigate and report upon the desirability of codifying laws relating to electric service companies. The principal issue raised before the board in the hearings was the extension of regulation by the commission to companies transmitting electrical energy from hydroelectric plants to consumers distributed over considerable areas. President Henry I. Harriman, of the Connecticut River Transmission Company, Boston, Mass., which covers many counties in central New England with its high-tension system, stated that he saw no real need for such regulation at present, as no abuses have been shown to exist in connection with the operation of this important system, which in his opinion does not fall within the definition of a public service corporation. The company supplies energy mainly for motor service on a very large scale; its lines are carried for about 90 per cent of their routes on private rights-of-way, and the whole character of the service is wholesale in its nature. By decisions of the commission, the company has been limited to supplying consumers of 300-hp connected load or over in the cities of Fitchburg and Worcester. Mr. Harriman contended that the public duties and responsibilities of such an organization are widely different from those of a central station, which is required to serve everyone in its field and which occupies the public highways to a large degree.

Mr. S. H. Pillsbury, counsel for the company, stated that when it entered the New England field only six large electric power contracts were held by Massachusetts central stations. The company is now selling more energy to

its comparatively limited number of consumers than the total production of all the central stations of the State with the exception of the Boston Edison company. Unusual risks attend the establishment of a successful hydroelectric undertaking, and these should be allowed to govern the rate of return permitted. Chairman Barker emphasized the point that the financing of public utility undertakings is frequently rendered easier by the fact that the enterprise is under state regulation, and stated that the question of risk is taken into account by the board in every central station or gas rate case which comes before it. Mr. E. W. Burdett, of Boston, counsel for the Massachusetts Electric Lighting Association, favored placing hydroelectric companies under state regulation, arguing that to a large degree their business parallels that of the central-station companies. Mr. Alton D. Adams, of Worcester, Mass., appeared at an earlier hearing in the interest of small power consumers and urged that the benefits of high-tension transmission and distribution from hydroelectric plants be accorded the "little fellow" as well as the big manufacturer. In response to this, Mr. Harriman said that his company was desirous of handling this class of business, but that the restrictions now in force confined it in large measure to wholesale consumers of energy. The hearing was closed, and a report will be made by the board to the next Legislature in January.

MARYLAND COMMISSION.

The Maryland Public Service Commission has received from the Consolidated Gas, Electric Light & Power Company and from Albert C. Ritchie, the people's counsel, their briefs setting forth the contentions of both sides on the question of whether or not the company shall sell electricity to its consumers at cheaper rates than it is now charging. Beginning next week the commission will hear the arguments on both sides and a decision will follow which will either reduce the rates, change their application or permit them to remain as they now are. Consumers in Baltimore are now paying 10 cents per kw-hr for electric energy and 90 cents per 1000 cu. ft. for gas. Mr. Ritchie declares that the price should be 7 cents for electric energy and 70 cents for gas. The brief of the Consolidated company is several hundred pages in length. One of its most important claims is as follows: "We feel confident that this commission will most cheerfully confirm our statement that the attitude of this company has been entirely in accordance with the policy advised by Justice Moody. This company has made frank disclosure of all of the facts and circumstances to this commission affecting this case, and all of the information asked for has been freely furnished to the commission and the people's counsel, even at a very considerable trouble and expense to the company. The policy of the company in the past has been to make voluntary reductions in the rates as fast as possible. Its policy for the future is the same. The best method of carrying this out is through the sliding scale, authority for which is expressly given in the Maryland law. The full investigation in this case has demonstrated the reasonableness of the existing rates for electricity and gas under the existing conditions, but the company is willing to confer with the commission on the details of the adoption of the sliding scale for the future, based on present rates for electricity and gas and present rates of stock dividends at the starting point, with a division of surplus earnings in the future between the public and the company."

OHIO COMMISSION.

Governor-elect Cox has asked Commissioner Hughes and Mr. W. L. Finley to make a study of the Wisconsin public utility laws with a view to recommending a revision of the law in this State in such a manner that the commission will have more real power. The Ohio law is supposed to have been patterned after that of Wisconsin, but changes were made before it was put to a vote to suit certain persons who would not support it otherwise. It is said that public utility men have indorsed the Wisconsin law and feel that the Ohio statute is not so well suited to its purpose. Mr. Cox has given considerable attention to this matter and among his first acts after entering office will be an attempt to have the law remodeled.

WISCONSIN COMMISSION.

The Wisconsin Railroad Commission has issued a decision ordering the Duluth Street Railway Company to establish a rate of six tickets for 25 cents on its lines in the city of Superior, in addition to the 5-cent cash fare now in force. The petition for lower rates was presented to the commission about two years ago by the Commercial Club of Superior. The respondent defended its present practice on the grounds that the rate of return upon the alleged valuation of the property was not excessive and that, furthermore, the 5-cent fare was the usual rate on traction lines. In regard to the latter contention, the commission pointed out that more than one-third of all the operating companies in the United States offer fares of less than 5 cents to all patrons and that 25 per cent offer fares of slightly more than 4 cents. The sale of six tickets for 25 cents was shown to be common practice in Michigan, Indiana, Illinois and Wisconsin. The rates filed with the commission by the urban companies in Wisconsin show that out of eighteen companies operating in the large cities of the State fifteen, or 83 per cent, have rates below 5 cents.

After an investigation on its own motion of the rules, regulations and practices of the Chippewa Valley Railway, Light & Power Company in force in the city of Eau Claire, the commission has ordered the company to abolish its present rates for incandescent lighting and to substitute therefor two optional schedules as devised by the commission. The investigation was carried out by the commission in response to numerous complaints alleging that the company had made it a practice to discriminate between its consumers in the classification of lamps and thereby in the rates charged. It appears that there is active competition in the city of Eau Claire between the gas and electric companies, and that it has been the custom of the defendant to discriminate in the matter of active lamps between those of its consumers who use electricity exclusively and those who use both gas and electricity. The company was ordered to establish a readiness to serve charge of 15 cents per month per active lamp of 50-watt capacity and an energy charge of 3 cents per kw-hr. For window or sign lighting one-third of the readiness to serve charge was to be levied. As to the classification of active lamps, two optional schedules were provided for, one based upon the classification of consumers into classes A, B, C, D and E, and the other upon the classification of rooms into active and non-active rooms. In the former classification, Class A will consist of residences in which 60 per cent of the connected load up to 500 watts and 33.3 per cent of the excess will be considered active; Class B, of stores, banks, merchandise establishments, etc., in which 70 per cent will be considered active; Class C, of hotels, federal, state and county buildings, schools, small factories, etc., in which 55 per cent will be considered active; Class D, of opera houses, churches, etc., in which 40 per cent will be active; Class E, signs 100 per cent active.

At the hearing the competing gas company objected to the practice of the Chippewa Valley company in refunding 25 per cent of the cost of equipment when motor service was contracted for, for a three-year period. The commission was of the opinion that a utility in competition with another is entitled to use whatever method it chooses in obtaining new business provided it does not offer rates or inducements which would result in the furnishing of energy at less than cost.

Current News and Notes

DATA ON ELECTRIC FAN.—Some one has taken the trouble to count the number of pieces in an electric fan and to measure the length of wire used in the coils. An ordinary 16-in. fan is said to contain 1372 ft. of wire and to possess more than 750 pieces of material.

* * *

PEORIA ELECTRICAL SHOW.—Encouraged by the success of the 1912 electrical show in Peoria, the promoters of the enterprise, headed by Mr. Leroy A. Mills, of the Mills Electric Company, will give a second show beginning on Jan. 18 and ending on Jan. 25, 1913. The exhibition will be given in the Coliseum at Peoria, Ill., and it is promised that it will be on a more elaborate scale than that of this year.

* * *

TRANSMISSION TOWERS FOR ENGINEERING SCHOOL.—The electrical engineering department of the Massachusetts Institute of Technology has been presented with two steel towers for transmission-line service by the Stone & Webster Engineering Corporation of Boston, Mass., and these will be erected in the near future in Cambridge to provide a 500-ft. span suitable for thesis investigations. The towers are equipped with suspension insulators designed to carry a 150,000-volt circuit. A study of dielectric hysteresis losses will be undertaken in connection with the towers.

* * *

TUNGSTEN-LAMP PRICES TO CENTRAL-STATION CUSTOMERS.—Some of the large central-station companies, including those in New York and Chicago, have announced the following schedule of tungsten-lamp prices: Ten-watt, 32 cents; 15-watt, 26 cents; 20-watt, 26 cents; 25-watt, 26 cents; 40-watt, 26 cents; 40-watt (large bulb), 36 cents; 60-watt, 33 cents; 100-watt, 38 cents; 150-watt, 57 cents; 250-watt, $1.07; 400-watt, $2; 500-watt, $2. These prices are for plain bulbs and apply only to customers entitled to free renewals of standard carbon-filament lamps.

* * *

ADJUDICATED PATENTS.—The Fessenden patent, No. 706,736, for apparatus for wireless telegraphy, has been held by the United States Circuit Court of Appeals not to be infringed in the case of the United Wireless Telegraph Company versus the National Signaling Company (see 198 Federal Reporter, 386). The Dodge patent, No. 894,487, for a battery, has been held by the United States District Court valid and infringed in the case of the Edison Manufacturing Company versus the Banks Electric & Manufacturing Company (see 198 Federal Reporter, 495).

* * *

INVESTIGATION OF BOARD OF SUPERVISING ENGINEERS.—The committee on local transportation of the city of Chicago has appointed a sub-committee, of which Alderman Eugene Block is chairman, to make the investigation of the Board of Supervising Engineers, Chicago Traction, ordered by the City Council. Irregularities and favoritism are not alleged, but the aldermen who have brought about the investigation wish to have the board show greater deference to the legislative branch of the city government. Mr. George Weston, the city's representative on the board, has written a letter welcoming the investigation.

* * *

INVESTIGATION OF SAN FRANCISCO TRACTION CONDITIONS.—Preliminary Report No. 6, submitted to the San Francisco Board of Supervisors, under date of Oct. 30, by Mr. Bion J. Arnold, consulting engineer, in connection with the investigation of traction conditions in that city, is devoted to means of relieving the traffic congestion on lower Market Street. The report is confined to a study of the physical conditions and the operative problems only, dealing with traffic regulation, car distribution, sources of delay, street capacity, loading, speed, arrangement of tracks, assignment of stops, etc. The present report has no bearing whatever upon any question of franchises or litigation.

* * *

PROPOSED PUBLIC SERVICE COMMISSION IN ILLINOIS.—Mr. Edward F. Dunne, Governor-elect of Illinois, is reported to be in favor of the creation of a public-service commission or commissions for the State of Illinois. Governor Deneen, who will retire on Jan. 1 next, has also expressed himself as favoring the regulation of public utilities by state commission. The subject is under advisement by the joint legislative committee known as the Illinois Legislative Public Utilities Commission (see *Electrical World* of Jan. 20, 1912, page 133), which will undoubtedly report at the session of the Legislature to begin in January next. Senator John Dailey, of Peoria, chairman of the joint committee, failed of re-election at the recent contest.

* * *

PRIZE WINNERS AT ELECTRICAL SUPPLY JOBBERS' ASSOCIATION MEETING.—The following is a list of the names of winners of prizes for the various contests at the meeting of the Electrical Supply Jobbers' Association at Hot Springs, Va., last week: Jobbers' golf, Messrs. Milnor, Philo, Little, Oberland and Havens; kickers' handicap, Mr. Seabury; manufacturers' golf, Messrs. Despard and Corey; kickers' handicap, Mr. Anschutz; ladies' putting contest, Mmes. Downs, Price and Rockafellow; pool tournament, Mr. McCullough; tennis tournament, Mr. Berry; billiard tournament, Mr. Fullerton; ladies' "500" contest, Mmes. Ward, Tonkin, Anschutz and Lillie; raffle, Mrs. Tonkin; ladies' bridge, Mmes. Low, Adams, Rockafellow and Burton.

* * *

PROGRESS OF ELECTRIFICATION STUDY IN CHICAGO.—At a recent meeting of the Chicago Association of Commerce committee of investigation on smoke abatement and electrification of railway terminals it was reported that the average steam-railroad locomotive in the city of Chicago is making smoke of a density computed to be 14.92 per cent, the emission of dense black smoke all the time being taken as 100 per cent. This is compared with an average density of 23.3 per cent when the city smoke inspector made an exhaustive investigation less than two years ago. (See *Electrical World*, Feb. 23, 1911, page 469.) The engineers of the committee also discussed phases of the study of electrifying Chicago railroad terminals, in the light of very complete information on the progress of electrification in New York and other cities.

* * *

CONFIDENCE MEN WORKING CENTRAL STATIONS.—The N. E. L. A. is advised by the Valdosta Lighting Company, Valdosta, Ga., that a gang of crooks has been successfully working central stations in various parts of the country by the following method: A foreigner dressed in the height of fashion, with a signet ring, gold-headed cane, etc., drives up in a carriage and informs the manager that he is representing his father, who is a large iron manufacturer in France or Germany, as the case may be. He explains that they have discovered a process of manufacturing tool steel by electricity and contemplate the establishment of a plant in this country to use electric power and would like to figure on rates. After interesting the central station in this way he suggests that the manager order a few sample bars of their tool steel at 55 cents per pound, f. o. b. point of delivery. After the order has been placed, ordinary tool steel, or such material as it may happen to be, will be shipped from the nearest jobber, subject to sight draft on a bill of lading which has been negotiated and is now held by a holder for value. Tool steel in bars of 18 ft. at 55 cents a pound offers a large profit to the promoter of this scheme.

SOCIETY MEETINGS.

Electric Vehicle Association of America.—The regular monthly meeting of the Electric Vehicle Association of America will be held in the Engineering Societies Building, New York, Nov. 26. What has been called a "smoke talk" has been arranged and the papers presented at the recent convention in Boston will be discussed.

* * *

November Meeting of New York Electrical Society.—At a meeting of the New York Electrical Society to be held in the Engineering Societies Building on Monday evening, Nov. 25, Mr. Horatio A. Foster will deliver an address entit ed "Reminiscences of an Electrical Engineer," which will cover twenty-five years of electrical development.

* * *

Chicago Section of Electric Vehicle Association.—At the meeting of the Chicago Section of the Electric Vehicle Association on Nov. 19 Mr. Henry Farrington presented a paper entitled "Let Us All Co-operate to Compete Against the Horse." On Dec. 10 Mr. H. J. Murphy, a garage man, will address the section on the electric-vehicle garage facilities of Chicago.

* * *

Industrial Education Convention.—The sixth annual convention ot the National Society for the Promotion of Industrial Education will be held at Philadelphia, Pa., on Dec. 5, 6 and 7. The headquarters of the society will be at the Hotel Walton, and all sessions of the society will be held there except that of Friday, Dec. 6, which will be in the auditorium of the William Penn High School. The first two sessions will be occupied with the questions of vocational education and the training of teachers. On the evening of Dec. 5 the annual banquet will be given at the Hotel Walton. At the meetings on Dec. 6 and 7 the questions of vocational education will be discussed.

* * *

Philadelphia Section, A. I. E. E.—A "municipal night" will be held Dec. 9 by the Philadelphia Section, American Institute of Electrical Engineers, at the Engineers' Club, 1317 Spruce Street, Philadelphia. The subject for discussion will be "Electrical Methods Used by Fire and Police Departments in Municipalities." The discussion will be opened with a paper by Mr. John W. Kelly, Jr., president of the International Association of Municipal Electricians. An informal meeting of the International Association of Municipal Electricians will be held the same day at 10 a. m. at the Electrical Bureau, City Hall, Philadelphia, to discuss plans for the advancement of the interests of the association.

* * *

National Fire Protection Association.—The electrical committee of the National Fire Protection Association will hold its regular biennial meeting some time during March, 1913, in New York City. The time and place of the meeting will be announced later. The provisions of the National Electrical Code as they now exist will be the principal matter for consideration, and the committee requests that any desired change in or addition to the code, including reports of sub-committees, be forwarded to Mr. Ralph Sweetland, secretary of the committee, 141 Milk Street, Boston, Mass., on or before Jan. 15, in order that they may be printed in the *Bulletin*. As heretofore, the meeting will be open to all interested, and such persons will not only be welcome but are urged to be present and give the committee the advantage of their advice and experience.

* * *

Telephone Pioneers of America.—More than 600 members of the Telephone Pioneers of America gathered at the Hotel Astor, New York City, on Nov. 14 for their second annual gathering, which lasted two days. Mr. Thomas A. Watson, one of the associates of Dr. Alexander Graham Bell in the early exploitation of the telephone, made a reminiscent address telling of the pioneer efforts to interest the public in its practical use. Other speakers were Mr. J. J. Carty, chief engineer of the American Telephone & Telegraph Company; Mr. U. N. Bethell, president of the New York Telephone Company; Mr. Emil Berlinger, Washington, D. C.; Mr. Samuel G. McMeen, consulting engineer, Chicago, and Mr. J. E. Kingsberry, London. In the evening the Pioneers and their guests were entertained with a cabaret and vaudeville performance. On the second day the entire gathering motored to Briarcliff Manor, N. Y., for luncheon, golf, tennis and other sports. The convention closed in the evening with the annual banquet, which was held at the Hotel Astor. At the business meeting the following officers were elected for the ensuing year: President, Mr. Theodore N. Vail; secretary and treasurer, Mr. H. W. Pope; vice-presidents, Messrs. F. H. Bethell, W. T. Gentry, B. E. Sunny and E. B. Field. The organization now numbers more than 1000 members.

* * *

Program Planned by Chicago Section, I. E. S.—For the monthly meetings of the Chicago Section of the Illuminating Engineering Society during the 1912-13 season, subjects and authors have been planned as follows: December: "Industrial Lighting," Mr. Ward Harrison, engineering department National Quality Division, General Electric Company, Cleveland, Ohio. January: "Indirect Illumination as Applied to General Offices," Mr. T. H. Aldrich, National X-Ray Reflector Company, Chicago, Ill. February: "The Influence of Colored Surroundings Upon the Color of Useful Light," Mr. M. Luckiesh, physical laboratory National Quality Division, General Electric Company, Cleveland, Ohio; "Some Applications of Illuminating Engineering to the Conservation of Eyesight," Mr. F. A. Vaughn, consulting engineer, and Dr. Nelson M. Black, ophthalmologist, Milwaukee, Wis. (this meeting is to be held at Milwaukee, in conjunction with the Milwaukee Electrical Show). March: "Hospital Lighting," Mr. Meyer J. Sturn, architect, Chicago, Ill. April: "Light, Shade and Color in Architectural Effects," Mr. Bassett Jones, Jr., consulting engineer, New York. May: "Up-to-Date Gas Illumination," author not selected. June: "Some Phases of Illumination and Eye Strain," Mr. Arthur J. Sweet, commercial engineer, Holophane Works of the General Electric Company, Newark, Ohio.

* * *

Efficiency Society.—The November *Bulletin* of the Efficiency Society, now being distributed, announces that a Chicago meeting has been planned for Nov. 25. A dinner will precede the meeting, which is in charge of a committee composed of Messrs. W. H. Hodge, of the H. M. Byllesby Company; F. M. Feiker, editor of *Factory*, and William J. Norton, secretary of the rate research committee of the National Electric Light Association. The dinner will be formal and the tickets will be $5 each. It is planned at this meeting to form a Chicago branch of the society. The dinner will be given in either the Sherman House or the Congress Hotel. A meeting of the society will also be held in New York on Nov. 29, at which the subject for consideration will be "Organizing an Industry." It is announced that Mr. Louis D. Brandeis, if possible, will take part in this conference. Another meeting will be held at Boston on Dec. 30, concurrently with the meeting of the American Economic Association, at which the topic will be the education of young men for business. The November number of the *Bulletin* contains an extended bibliography of general works on efficiency, dealing somewhat specifically with efficiency in shop management. In time the society will probably issue bibliographies dealing with efficiency in other special lines of work. The society headquarters are 29 West Thirty-ninth Street.

CENTRAL-STATION PRACTICE AT HALIFAX, N.S.

Generating Station of the Halifax Electric Tramway Company, Ltd., Which Supplies Energy for Railway, Lighting and Industrial Service.

Description of Steam Equipment with Tests of Hand-Fired and Stoker-Fired Boilers Burning Culm—Outline of Service Conditions and Details of System Operation—Effect of Tungsten Lamp on Station Peak—Growth of Load Unaided by Solicitors.

ELECTRICAL service at Halifax, Nova Scotia, is a conspicuous feature of the industrial and domestic life of the Acadian capital, which has for many years attracted the tourist on account of its historic interest and distinctly English characteristics. The development of electrical applications in the community has been rapid within the past few years, and although the field is a somewhat peculiar one in view of the predominance of governmental and residential interests in the city, comparatively little manufacturing being done, the growth of the income of the Halifax Electric Tramway Company, Ltd., from 1900 to 1911 inclusive is impressive. In the former year the company's revenue was $232,767; in 1911 it totaled $502,399, and this gain was made in the face of substantial rate reductions and without the use of professional new-business solicitors. The connected lighting load of the company approximates one and a half 50-watt incandescent lamps per capita.

The present company represents the consolidation of a number of smaller organizations which supplied electrical service to the city from twenty to twenty-five years ago, including the plant of the Nova Scotia Electric Light Company on Black Wharf, built in 1888; the Chandler Electric Light Company, started the year before on the Northwest Arm, by Mr. B. F. Pearson and associates; the Halifax Electric Light Company, and the Halifax Illuminating & Motor Company. These organizations were purchased in 1895 by the Halifax Electric Tramway Company, Ltd., and in the following year electric traction was introduced upon the streets of the city. All the railway, lighting and industrial service of the city, including a small gas business, is now supplied by the company under the management of Mr. J. W. Crosby, a well-known American central-station and railway executive. Canadian financial interests are in control of the property, and the population served is about 50,000.

GENERATING STATION.

The generating plant of the company is located on tidewater at a point about half a mile east of the center of the city and facing the harbor. The station is a brick and steel structure with concrete foundations carried on piles driven in made land, and the building is 120 ft. long by 110 ft. in width. The piles were driven two abreast under the station walls. The engine foundations were carried to a depth of 15 ft. below the floor, 130 piles being driven below each, while 135 piles were driven in the construction of the foundation of the chimney, which has an inside diameter of 9 ft. and a height of 90 ft. above the grate bars. The stack

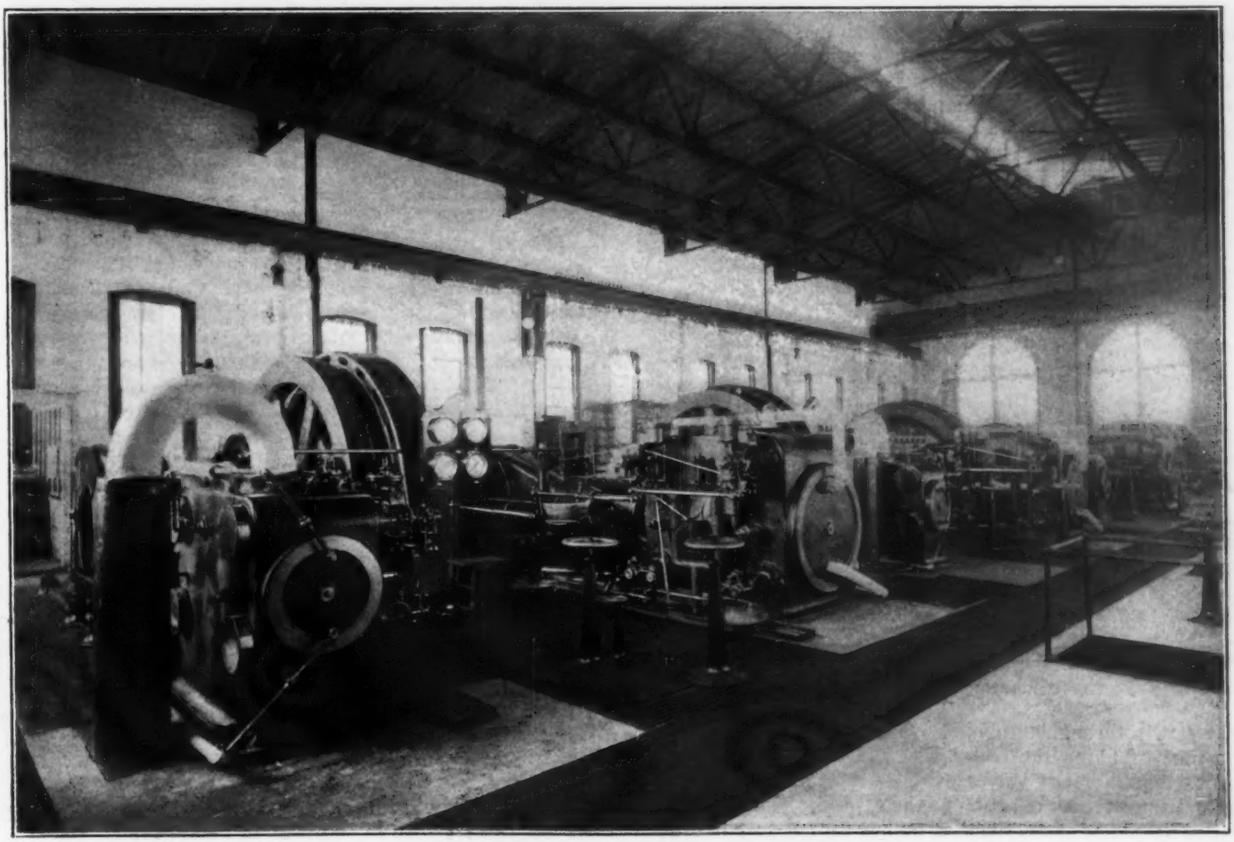


Fig. 1—Interior of Generating Station at Halifax.

is of Custodis construction and is connected with the boiler flues by a reinforced-concrete breeching passing between the base of the chimney and the building.

BOILER PLANT.

The steam generating plant contains seven 300-hp Babcock & Wilcox boilers, which deliver steam at 150 lb. pressure and 100 deg. Fahr. superheat. Each boiler is equipped with two Jones underfeed stokers which are fed manually from fuel piles in front of the furnaces. The boilers are installed in a single row facing a wide firing aisle, in front of which are doors leading to a coal storage and receiving yard bordering on the harbor, so that shipments of fuel can readily be taken from barges for the service of the plant. The draft for the stokers is supplied by two 92-in. by 24-in. fans of Sturtevant make driven by single-cylinder engines, the stoker mechanism also being operated from the shaft of the blower engines. A Foster regulator controlling the steam pressure within 5 lb. is used on the steam main supplying the fan engines. When the steam pressure falls the regulator admits more steam and speeds up the fan and stoker equipment. The maximum draft is about 1.5 in., and the regulator is provided with a dashpot to reduce fluctuation in its operation.

Two outside-packed boiler-feed pumps are in service, water being taken from the city mains. Induction heaters in the exhaust piping of each engine and a Cochrane open heater raise the feed-water temperature to about 212 deg. as it enters the boilers. The exhausts from the feed pumps and stoker engines and the drips from the local carhouse and office heating system also discharge into the open heater. The average temperature of the water received from the induction heaters is 90 deg. Fahr. Two 6-in. connections are made with the city mains.

CARE OF BOILERS.

In the maintenance of the boilers each unit is shut down once in five weeks. When a boiler is taken off the line for cleaning or overhauling it is pumped or injected full of water in which about 20 lb. of sal-soda has been dissolved while it is still under pressure and the stop valve closed. After it is allowed to remain forty-eight hours the blow-off is opened and the boiler is emptied, thorough cleaning being secured by opening the feed valve and allowing water to

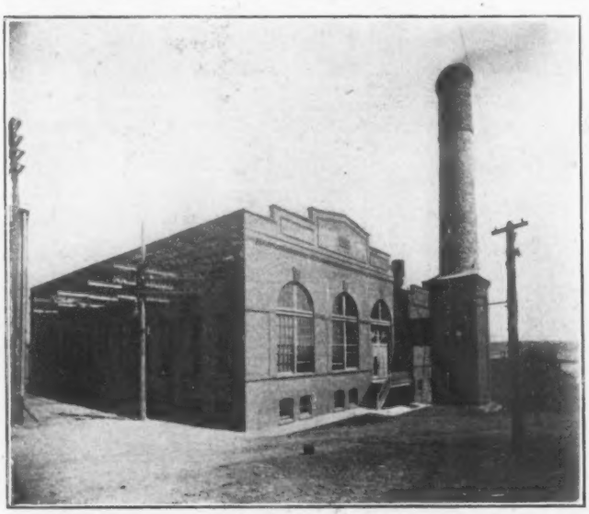


Fig. 2—The Generating Station at Halifax, N. S.

flow slowly through the boiler. Special pains are taken at the time of filling the boiler with the sal-soda solution to insure that the feed valves are closed in order to protect brass fittings from the action of the sal-soda. The company makes a practice of overhauling pumps once a week in order to detect any faults. Special care is given to water plungers and valves. Brass valves are used in the feed pumps of the Halifax station. Fire protection is insured by an 18-in. by 10-in. by 12-in. Underwriters' pump having a capacity of 1000 gal. per minute with a 9-ft. lift. An emergency storage tank of 40,000 gal. capacity is located under a storeroom at one side of the station, and this is connected with the city water mains and the fire pump, a suction pipe also being connected from the latter to the harbor, so that the local

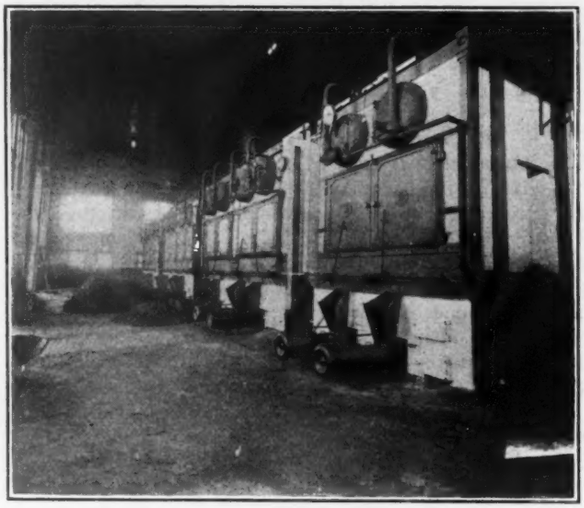


Fig. 3—Boiler Room, Halifax Station.

fire protection system may be fed either from the city mains or the harbor. The city water pressure is 60 lb., and in emergencies the fire pump at the station can be used to pump salt water into the city mains. The feed-water piping is equipped with a thermostatic regulator, controlling the amount of steam admitted to the open heater from the station auxiliaries, and an automatic valve which starts and stops the feed pumping equipment according to whether the heater is partially or completely filled with water.

ENGINES AND TURBINE EQUIPMENT.

The engine room, which is built above the boiler-room level and separated from the latter by a fire wall of brick, contains the main generating units, the switchboard and various electrical auxiliaries, with a glass-partitioned office at one end for the use of the chief engineer. Three Rice & Sargent engines are in regular service, each being an 18-in. by 36-in. by 32-in. horizontal, cross-compound condensing outfit running 150 r.p.m. and directly connected to a 600-kw, 2300-volt, three-phase, revolving-field Canadian General Electric Company alternator delivering 60-cycle energy to the busbars. These engine units are provided with jet condensers, salt water from the harbor being used for injection purposes. Very recently there has been installed in the station a 2000-kw horizontal Curtis-General Electric turbo-alternator wound for 2300 volts, three-phase service, and operating at 3600 r.p.m. This unit occupies a floor space of only 19.5 ft. and has been installed on a reinforced-concrete foundation at one end of the engine room, no enlargement of the latter being required to house it. The new unit is equipped with a 4800-sq. ft. Worthington surface condenser, capable of condensing 35,000 lb. of exhaust steam per hour and maintaining within its interior 2 in. of absolute pressure when supplied with not less than 3500 gal. of circulating water per minute at not over 65 deg. Fahr., free of air, the initial steam pressure being 145 lb. and the superheat 64 deg. Fahr. A 35-kw, 125-volt, compound-wound turbo-exciter was also furnished with this unit. The other auxiliaries, which are located in the basement, include a 12-in. horizontal volute centrifugal circulating pump directly driven by an 8-in. by 7-in. Blake vertical engine; a 10-in. by 18-in. by 10-in. horizontal, center-crank, steam-driven rotative dry-vacuum pump, and a 2.5-in. two-stage hot-well pump driven by a 7-hp Terry steam turbine.

OILING SYSTEM.

An extensive oiling system is in use in the station, requiring one receiving tank, a 200-gal. Cross oil filter and two pressure tanks of galvanized iron. Used oil and water associated with it flow from the engine room into a receiving tank in the basement, the latter being piped so that the water flows into the city sewer, while the oil passes through

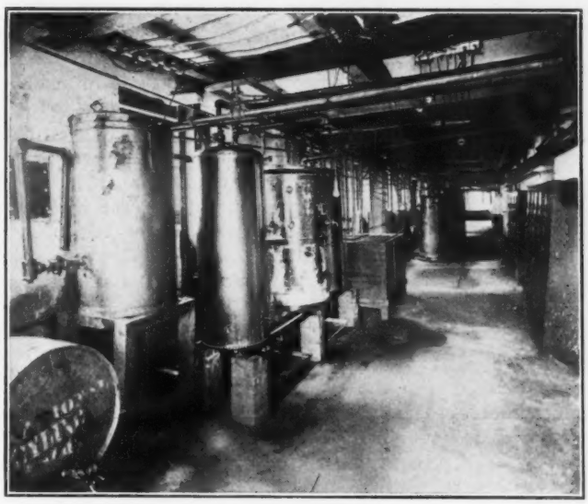


Fig. 4—Oil-Filtering Plant in Basement.

an overflow pipe into the filter. On the bottom of the two pressure tanks a city water pipe is connected and arranged to give about 35 lb. pressure on the oiling system. From each jet condenser a 1-in. pipe main is connected to the pressure tanks. To operate, the city water supply is closed and the valves on the filter or barrel are opened, that on the condenser suction line also being opened. The vacuum takes the water out of the tank and the oil takes the place of the water in the pressure tank at no cost for power. On the engine-room floor there are two oil-waste presses made of 12-in. pipe, these being about 24 in. long with 1¾-in. screws, five threads to the inch, and equipped with 12-in levers. In the company's old plant waste was pressed by hand to extract the oil. Since purchasing the waste press the consumption of waste has been reduced from 5 lb. to 1 lb. per day. The oil is piped to the bearings of the machinery in the engine room in the usual manner.

SWITCHBOARD.

The auxiliary electrical equipment of the station consists of three 330-hp induction motors directly connected in each case to a 225-kw, 575-volt direct-current generator designed for railway service and a 300-kw synchronous motor-generator set for 575-volt direct-current motor service. Two induction motor-driven sets and one engine-driven exciter set complete the equipment, with the exception of five 100-light series-arc tub transformers in the basement, which supply the local street lighting at 7.5 amp, with a fifty-lamp 6.5-amp transformer for commercial arc-lighting service. The main switchboard is on the floor of the engine room and contains twenty panels equipped with the usual controlling and measuring devices. Watt-hour meters are installed on all lighting circuits, in the leads of each generator and in the synchronous and induction motor leads. The various sections of the switchboard handle the street-lighting, commercial incandescent lighting, industrial and railway service station auxiliaries. Bristol recording voltmeters are used on the busbars and in connection with pressure wires brought back to the station from important centers of distribution. The railway service is fed through a single feeder panel on a south and north separation of the city lines, and three street-lighting and three incandescent-lighting and motor panels are installed. The normal electric railway schedule of the city requires the operation of twenty cars.

DISTRIBUTION.

The service of the station is handled by 2300-volt lines carried overhead on poles of from 30-ft. to 40-ft. length, all feeders being of No. 0 copper and all series arc lines being of No. 6 wire. Hard pine poles are used in the center of the city, chestnut poles being generally employed in the suburban districts. Five three-phase and two single-phase circuits handle the commercial 2300-volt service. The usual span between feeder poles is 120 ft. Nine arc circuits are in operation. Elevator motors rated at about 100 kw are connected to the 575-volt direct-current circuit of the company, these being supplied from a separate feeder connected at the station switchboard with the synchronous motor-generator set above referred to. The station is equipped with General Electric type regulators on each feeder. The city is lighted by about 400 inclosed alternating-current arc lamps, and the commercial arc service includes about 150 lamps of the 6.5-amp size. About 70,000 16-cp equivalents are now in service on the company's system of incandescent lighting mains. The connected motor load, mainly in small units, aggregates about 1150 hp. The municipal arcs are supplied with energy on an all-night and every-night schedule at a price of $62.50 per lamp a year. The cost of coal at the generating plant is about $2.75 per long ton. No wire smaller than No. 8 is used in leads to consumers' residences. Three-wire secondaries are extensively used by the company, the neutrals being of No. 0 section, and grounded on water pipes. No. 00 wire is generally used in the outers in the secondary distribution. The largest transformer in service is rated at 50 kw. All meters are tested by a Westinghouse rotating standard, those in service being checked once a year.

No flat-rate service is in use at Halifax, and the electric vehicle has not made an appearance in the city. Battery charging for the Nova Scotia Telephone Company and the Western Union Telegraph Company is regularly done by the company, and its industrial load is obtained from newspaper plants, ice-cream plants, clothing factories, machine shops, etc. A variety of service is also obtained in the government shipyards. British warships placed in the local drydock are regularly supplied with electricity from the

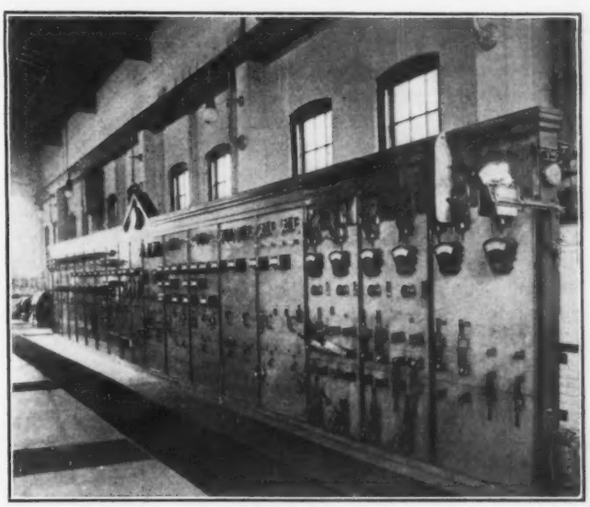


Fig. 5—Main Switchboard.

company's mains during the period of their stay, and at the recent visit of the cruiser *Niobe* a continuous load averaging 85 kw was fed in this way. The Halifax and Queen Hotels, the new Anglican cathedral, St. Paul's Church and many other noted houses of worship, hostelries and military establishments are on the company's circuits. A description of the use of tungsten lamps in the lighting

of St. Paul's Church, Halifax, was given in the *Electrical World* of Sept. 21 last, page 616, this being one of the most noted examples of modern illumination in the Maritime Provinces.

The company has a total of about 3300 customers on its books. It is noteworthy that when the tungsten lamp came into service the station peak was cut so much that no additional equipment was required for two years in the generating system. The company does not renew lamps, exhibit energy-consuming appliances or maintain solicitors. Despite this policy the demand for its service has increased steadily. Table I shows some of the features of the company's growth in the past decade.

TABLE I.—STATISTICS OF HALIFAX COMPANY'S GROWTH IN TEN YEARS.

	1901.	1911.
Total earnings	$251,644	$502,399
Operating expenses	$142,412	$256,874
Net earnings	$79,232	$215,525
Electrical earnings	$113,927	$211,161
Surplus	$39,232	$103,525
Ratio operating expenses to earnings, per cent.	56.84	51.97
Passengers carried	3,037,268	5,212,257
Incandescent lamps connected	23,343	63,718

The rate for electrical service except motors is 15 cents per kw-hr., with a minimum monthly charge of $1.33 in lighting installations. On bills of from $1.33 to $9.99 a 25 per cent discount is given for prompt payment, and on larger bills the discount increases up to a maximum of 45 per cent for a monthly bill of $100 or over. A straight rate

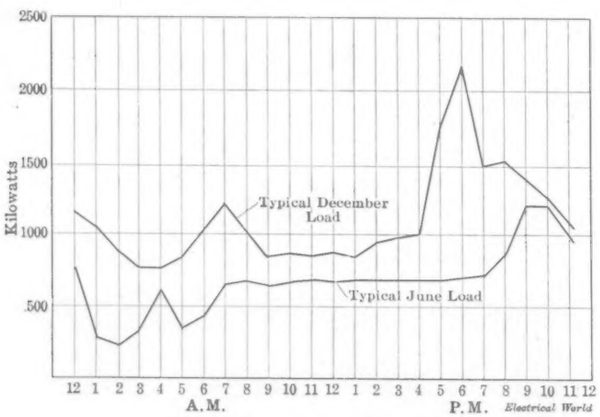


Fig. 6—Typical Load Curves.

of 10 cents per kw-hr. is charged for electric motor service, coupled with a minimum monthly charge of $2.22, which also applies in arc-lighting installations. The company runs its wires to the outside of the building, and in cases where the mains do not pass a building the customer pays a proportion of the cost of reaching him. All inside wiring, fixtures, lamps, motors, etc., are installed at the expense of the consumer. The company, however, does not undertake inside wiring. In case the supply is used for less than twelve months the consumer is required to pay the company the cost of the labor of making the connection and of discontinuing it.

LOAD CURVES.

Representative station load curves are shown in the accompanying drawing. The load on a typical summer day ranges from a minimum of about 240 kw to a maximum of 1240 kw, occurring in the late evening. The long twilights of a northern latitude noticeably affect the time of the peak in the month of June. A typical winter load curve shows a range of from about 750 kw minimum to about 2200 kw maximum, the latter occurring at about 6 p. m. on a December day. The average load on the station for the year 1911 was 850 kw, the maximum being 2300 kw, and the load-factor for the year was 37 per cent. At present the peak load on the lighting service totals about 1400 kw, and that of the railway service 600 kw. The maximum motor load is about 220 kw.

The following statement gives the arrangement of working shifts in the plant: Engine room—12 midnight to 10 a. m., one engineer, one oiler; 7 a. m. to 6 p. m., one engineer and electrician, one oiler; 2 p. m. to 12 midnight, one engineer, two oilers. Boiler room—6 p. m. to 4 a. m., one fireman; 10 p. m. to 8 a. m., one fireman; 8 a. m. to 6 p. m., one fireman; 12 noon to 10 p. m., one fireman and coal trimmer; 7 a. m. to 6 p. m., one head fireman.

The arrangement of day and night runs is changed about every two weeks in the engine room and every week in the boiler house. The operating payroll also includes one machinist, one steam fitter and one helper, the last-named being used on outside repair work. There has been no change in the personnel of the station for five years, and all the engineers in the plant have been in its service for the past seventeen years.

BOILER TEST WITH HAND AND STOKER FIRING.

In Table II are given the principal details of a test of one of the boilers in the plant under hand firing and with mechanical stokers. The test lasted practically twelve hours. The boiler had 56 sq. ft. of grate surface and 2789 sq. ft. of heating surface, the ratio of the latter to the former being 49.8 to 1. Cape Breton culm was burned, this having 3.1 per cent moisture by a representative analysis.

TABLE II.—BOILER TEST DATA.

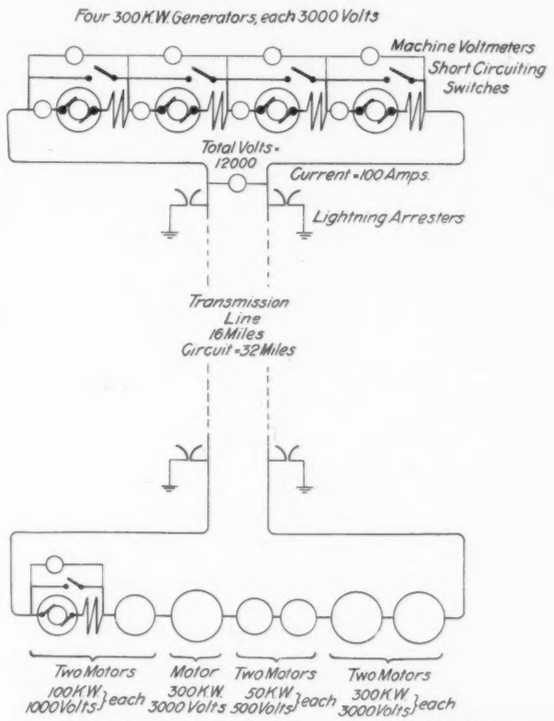
	Hand Firing.	Stokers.
Steam pressure by gage, lb.	126.3	129.3
Absolute steam pressure, lb.	141	144
Draft in flue, inches of water	0.23	0.23
Temperature external air, deg. Fahr.	33.5	30.3
Temperature fire room, deg. Fahr.	58.6	56.6
Feed-water temperature, deg. Fahr.	149.5	149.5
Total amount of coal from pile, lb.	15,262	12,639.5
Percentage of ashes and clinkers	5.3	5.1
Total water pumped into boiler in cu. ft.	1597.7	1585
Total water as above, lb.	97,747	96,970
Water from feed temperature evaporation per hour, lb.	8207.1	8080.8
Water evaporated per pound of coal from pile, lb.	6.4	7.67
Equivalent evaporation from and at 212 deg. Fahr. per pound of coal from pile, lb.	7.09	8.51
Above, per pound of dry coal, lb.	7.30	8.77
Above, per pound of combustible, lb.	7.74	9.2
Percentage of exhausts of steam engine and stoker to total water	.....	5.6
Percentage of total water evaporated used in steam jet	2.5	
Coal per square foot grate surface per hour, lb.	22.58	18.66
Dry coal from pile, as above, lb.	22.17	18.20
Combustible per hour, as above	20.98	17.26
Cost of coal per ton, as used	$1.40	$1.40
Average hp. developed	263.7	259.9

The test was made under the direction of Mr. Philip A. Freeman, superintendent and chief engineer of the company, and shows that the relative economies of hand firing and mechanical stoking are as 100 to 119.8, neglecting steam used in the jet in connection with the former and that consumed in the stoker-engine equipment in the latter; or, after deducting the steam used in the stokers and engines, there is a saving of 14.2 per cent in the use of mechanical stokers. In one year's actual operation with stokers as against hand firing the plant showed a gain of 11 per cent in fuel for the stokers. The automatic feed attachment described above for supplying the stokers with fuel and air according to the status of the steam pressure saved an additional 10 per cent in fuel. With hand-fired practice the company had to rebrick the boiler walls four times each year. With stokers this has to be done only about once in nine months. The cost for spare parts for stokers for one year is about half the former cost of grate bars under hand firing.

THE THURY SYSTEM OF POWER TRANSMISSION BY CONTINUOUS CURRENTS.

BY ALFRED STILL.

IN the Thury system of electric power transmission by continuous currents the current is constant in value and the pressure is made to vary with the load. All the generators and all the motors are connected in series on the one wire, which may be in the form of a closed loop serving a wide area, or it may consist merely of the outgoing and returning wires between a power station containing all the generators and one or more substations, with motors, at the end of a direct transmission. It is the latter arrangement (direct long-distance transmission) for which the Thury system is specially adapted. The cut shows a typical arrangement of machines for a small installation on this system. There are four generators at one end of the line and seven motors of various capacities at the other end of the line, all the machines being connected in series and provided with short-circuiting switches. The connections are, however,


Four 300 K.W. Generators, each 3000 Volts
Machine Voltmeters
Short Circuiting Switches
Total Volts = 12000
Current = 100 Amps.
Lightning Arresters
Transmission Line 16 Miles Circuit = 32 Miles
Two Motors 100 K.W. 1000 Volts each
Motor 300 K.W. 3000 Volts
Two Motors 50 K.W. 500 Volts each
Two Motors 300 K.W. 3000 Volts each

Direct-Current Power-Transmission Installation.

so simple that the diagram is self-explanatory. The voltage at the terminals of any one dynamo is limited, as the necessity for a commutator renders it impossible to wind a continuous-current machine for a pressure as high as may be obtained from alternating-current machines. The limiting pressure per commutator on the existing Thury systems is 3660 volts, this being on the Moutiers-Lyons transmission; the lowest is 1300, on a small two-generator plant in Russia.

In order to obtain the high pressures required for economical transmission over long distances, it is necessary to connect many generator units in series, the difficulty of insulation between machines and ground being overcome by mounting the dynamos and motors on insulators and providing an insulated coupling between the electric generators and the prime movers, as well as an insulating floor.

When a machine, whether generator or motor, is not in use, it is short-circuited through a switch provided for this purpose. As the motor load varies, generators are switched in or out of circuit, thus varying the total voltage. When it is required to switch in an additional generator, the machine is brought up to speed and its field excitation adjusted until it gives the proper line current before the short-circuiting switch is opened to throw the machine in series with the line. To start up a motor, the short-circuiting switch is opened when the brushes are in the neutral position. The brush rocker is then gradually moved round, and the motor, starting from rest, increases in speed until the brushes are in the required position, the actual speed for any particular position of the brushes being dependent upon the load.

The motors may be distributed anywhere along the line, either on the premises of private users of power, where they may be directly coupled to the machinery to be driven, or in substations, coupled to constant-pressure electric generators giving a secondary supply for lighting and power purposes. In most of the Thury undertakings in Europe this secondary supply is three-phase alternating current.

A series-wound dynamo machine, with a current of constant value passing through field-magnet and armature windings, is essentially a constant torque machine. In the case of a motor, if the load is decreased, the motor will increase in speed and tend to "run away"; with increase of load, the motor will slow down and in time come to a standstill. In regard to the generators, the ideal prime mover is one which will give a constant torque, such as a steam engine with fixed cut-off and constant steam pressure, and a single generator so driven would be practically self-regulating and maintain constant current regardless of load, as the speed—and therefore the pressure at terminals—would adjust itself to suit the motor load. The generators are, however, usually driven by prime movers which are far from fulfilling the ideal conditions. Most of the Thury stations are driven by water turbines, which are most efficient as constant-speed machines, while the maximum torque at low speeds is generally about twice the torque under conditions of highest efficiency at normal speed.

Just as various devices are provided, when working on the parallel system, to maintain constant pressure of supply, so in the series system it is necessary to provide regulating devices to maintain a constant current. Regulators controlled by the main current, or by a definite fraction of the main current, passing through a solenoid, can be made to act on mechanisms designed to vary the speed of the prime movers. This method is quite practicable, but where the type of engine—such as a waterwheel under constant head—is not suited to variable-speed running, the machines may be run at constant speed and the automatic device made to alter the resultant magnetic field cut by the armature conductors, this being the only alternative means of varying the voltage generated. The alteration of the effective magnetic flux may be effected:

(1) By shunting a portion of the main current so that it shall not all pass through the field winding, and

(2) By shifting the position of the brushes on the commutator.

A combination of both methods appears to give satisfactory results. The first method alone is liable to lead to sparking troubles because of the relatively greater armature reaction due to the weakening of the field, and in practice it is found inadvisable to shunt more than one-third of the total current. It is, of course, understood that the large variations of voltage are obtained by connecting more or fewer generators in series on the line.

The motors, whether connected directly to the machinery of mills or factories or used for driving sub-generators of the constant-pressure type, are usually required to run at constant speed. Their regulation is effected by a small centrifugal governor which rocks the brushes by acting on intermediate mechanism driven by the motor itself. The braking or reversal of a motor is most simply effected by shifting the brushes around, through the neutral position, until the current reverses in the armature coils.

A short-circuit on a motor merely removes that portion of the total load from the system, and the regulators on the generators will readjust the pressure accordingly. If a

short-circuit occurs on a generator, the prime mover may be protected from the shock by a slipping coupling, which is commonly provided. If, owing to the failure of a prime mover, a generator tends to reverse and be driven as a motor, it may be short-circuited by a switch that can very easily be made to operate automatically on reversal of rotation.

With regard to the motors, the only safety device required, when a constant-speed governor is provided, is a simple attachment which will automatically close the short-circuiting switch in the event that the voltage across terminals becomes excessive, such as would be the case on a heavy overload.

Electrical engineers on the American continent are rather inclined to the belief that when power has to be transmitted from one place to another the one and only course open to them is to adopt the three-phase alternating-current system. It is not suggested that at the present time this may not, in the majority of cases, be the best system available; but undoubtedly there are conditions under which the continuous-current series system would prove more economical.

ADVANTAGES OF THE DIRECT-CURRENT SERIES SYSTEM.

(1) The power-factor is unity—a fact which alone accounts for considerable reduction of transmission losses.

(2) Higher pressures can be used than with alternating current, the conditions, as shown by actual tests, being more favorable to direct-current transmission than is generally supposed. Without any alteration to insulation or spacing of wires, approximately double the working pressure can be used if direct current is substituted for alternating current. Moreover, the insulation is subjected to the maximum pressure only at times of full load, whereas on the parallel system the insulation is subject to the full electrical stress at all times.

(3) There is no loss of power through "dielectric hysteresis" in the body of insulating materials.

(4) The necessity for two wires only, in place of three, effects a saving in the number of insulators required and allows cheaper line construction.

(5) Where it is necessary to transmit power by underground cables continuous currents have advantages over alternating current. Single-core cables can be made to work with continuous currents at 60,000 volts. By using two such cables and grounding the middle point of the system it is, therefore, quite feasible to transmit underground at 120,000 volts.

(6) The practicable distance of transmission, especially when the whole or a part is underground, is greater than with alternating currents.

(7) There are no induction or capacity troubles and no surges or abnormal pressure rises due to resonance and similar causes, such as have been experienced with alternating currents. This virtually makes the factor of safety on insulation greater than on alternating-current circuits, even when the working pressure is doubled.

(8) A number of generating stations can easily be operated in series, and when the demand for power increases a new generating station can be put up on any part of the line if it is inconvenient to enlarge the original power station.

(9) The simplicity and relatively low cost of the switch gear is remarkable. A switch pillar with ammeter, voltmeter, and four-point switch is all the necessary equipment for a generator. The switch pillar for a motor includes, in addition, an automatic "by-pass" which bridges the motor terminals in the event of an excessive pressure rise. This compares very favorably with the ever-increasing—though in some cases unnecessary—complication and high cost of the switching arrangements in high-tension power stations on the parallel system.

(10) With the Thury system any class of supply can be given, and the motors can be made to drive sub-generators capable of running in parallel with any local electric generating plant.

(11) In hydraulic generating stations where the variations of head are considerable, as would generally be the case if there is no storage reservoir, a greater all-round efficiency can be obtained than if the machines had to be driven at constant speed.

(12) For any industrial operation requiring a variable-speed drive at constant torque, the Thury motor, without constant-speed regulator, is admirably adapted. It might have a useful application in the driving of generators supplying constant current to electric furnaces in which the voltage across electrodes is continually varying.

DISADVANTAGES OF THE DIRECT-CURRENT SERIES SYSTEM.

(1) The necessity of providing insulating floors and mounting all current-carrying machines and apparatus on insulators. The highly insulated coupling required to transmit, mechanically, large amounts of power between prime mover and electric generator is also objectionable.

(2) The smallness of the generators, the output of each generator being limited by the line current and the permissible voltage between the collecting brushes on the commutator. One prime mover is usually coupled to two or more direct-current generator units. This, however, is necessarily more costly than if larger electric generators could be used; moreover, it practically limits the choice of hydraulic turbines to the horizontal type, since the coupling of several generators on the shaft of a vertical waterwheel would be difficult and unsatisfactory.

(3) With constant current on the line, the line losses are the same at all loads, and the percentage power loss in conductors is inversely proportional to the load. This is exactly the reverse of what occurs on the alternating-current parallel system, in which the percentage line loss is directly proportional to the load. It should, however, be mentioned that on the Thury system the line current may be reduced about 30 per cent at times of light load, except when the circuit feeds motors of industrial undertakings requiring constant current day and night. It must not be overlooked that large percentage losses at times of light load are of serious moment only where steam engines are used or where storage reservoirs are provided for water-power generating stations. In the case of water-power schemes without storage the fact of the full-load line losses continuing during times of light load is not objectionable.

(4) The series system is less suitable than the parallel system for distribution of power in the neighborhood of the generating station.

(5) The water turbine working under constant head is not the ideal engine for driving constant-current machines.

(6) The necessity of special regulating devices to maintain constant speed on the motors.

(7) The impossibility of overloading the motor, even for short periods. This would be a very serious objection to the use of these motors in connection with electric traction systems.

(8) Greater liability to damage and interruption from the effects of lightning. It may be said that an overhead line, whether for alternating or direct current, is always liable to damage by lightning; but with the high-tension alternating-current system the transformers and automatic oil switches will usually protect the generators themselves from serious damage, while with the Thury system there is always a path for lightning discharges through the generators and motors, and the damage done may be very great. This simply means that particular attention should be given to the question of lightning protection on direct-current overhead lines, and the ease with which highly inductive choke coils can be introduced on a direct-current system, without opposing any obstacle (except ohmic resistance) to the passage of the line current, tends toward the attainment of increased safety.

HIGH-TENSION DISTRIBUTION IN NORTHERN ILLINOIS.

Some interesting data concerning the operation of the recently formed Public Service Company of Northern Illinois and the Illinois Northern Utilities Company, both managed from Chicago and serving a large number of communities, were given in a paper read by Mr. H. B. Gear at the recent Peoria convention of the Illinois State Electric Association. What follows is taken from the paper.

The southern transmission system of the Public Service Company is operated chiefly at 33,000 volts, 60 cycles. The northern system is operated at 20,000 volts with subsidiary lines on the four-wire system at 4600/8000 volts. The use of 33,000 volts will be made standard throughout the system ultimately. The main generating stations are from 25 to 50 miles apart, and this voltage is therefore sufficiently high for the average distances of transmission. It is low enough to permit transformers as small as 25 kw to be used in the supply of substations in small towns, and it is well within economical limits in the construction of pole lines. With towns 10 to 15 miles apart, having loads of 50 kw to 150 kw, the line drop is so small that little pressure regulation is needed at substations.

The main transmission system must necessarily be carried over routes which will touch as many towns as possible and therefore naturally follow the general direction of railroads. This results in a system of radial lines which will ultimately be tied together by cross-country lines so placed as to form ring systems which will provide reserve supply for the more important towns, some of which are at present operated without a reserve supply. At important junction points switching facilities are provided to permit of ready change of connections in case of emergency and for other operating conditions. Some of these are outdoor air-break switches, and others are in substation buildings. The lines are maintained between the generating stations at Joliet and Blue Island, and between Blue Island and Maywood, so that surplus capacity in any of these stations is available.

Main lines thus far constructed are of No. 2 B. & S. copper. These lines will distribute from 3000 kw to 4000 kw at various points in the district within a radius of 30 miles from the generating stations, with not over 10 per cent drop to any point. Branch lines of No. 4 wire are used in a few cases.

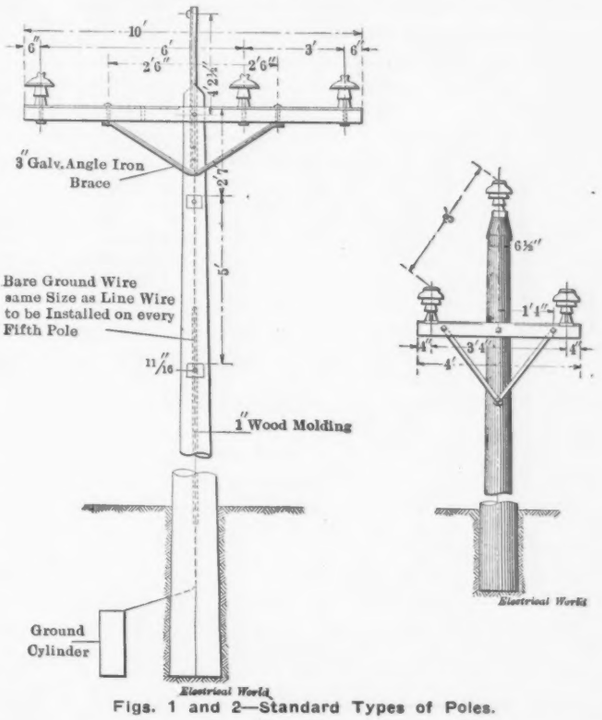
Three types of construction have been standardized for transmission lines, which have been designated as Class A, Class B and Class C. In Class A construction poles are designed to carry one or two lines, as shown in Fig. 1. The illustration shows the pole as equipped for one line with space reserved for a second arm and three additional wires when needed. The spacing between wires in the final arrangement is 3 ft. Poles are set approximately forty-four to the mile, and no poles less than 30 ft. long with 7-in. tops are used. A ground wire is carried on an angle-iron fixture extending above the top of the pole, and space is provided for a private telephone line on a lower arm. This type of construction is used on all main lines between generating stations.

Poles erected under Class B construction are framed with two arms carrying two pins each. One end of the top arm carries a fourth wire which acts as a ground wire. This construction is similar in other respects to Class A and is used on important lines where it is not expected that more than one set of wires will be required for some years to come.

Class C construction (Fig. 2) is designed for use on branch lines which will not become part of a main line and where the amount of business served does not justify the expense of Class A construction. Where branch lines are likely to become a part of a 33,000-volt line later, the use of Class B construction permits the branch line to be operated as a four-wire, three-phase line at 2300-4000 or 4600-8000 volts, using the ground wire as the neutral, until such time as the line is needed as a part of the 33,000-volt system. Copper-clad steel wire may be used as neutral conductor if necessary in cases where the load is more than the stranded steel cable which will be used for ground wire is equal to carrying.

The advantage of using 4600-8000-volt lines in this way consists chiefly in the ability to eliminate a substation by placing the regulators at a point where a substation is already established. In some cases 4600-volt distribution transformers are used for the larger consumers, but where there is a 2300-volt distributing system two to one step-down transformers must be used at the far end. Several towns and communities are supplied by four-wire, 4600-8000-volt feeders in the northern part of the Public Service Company's system.

In the Illinois Northern Utilities Company's system the present lines are being operated chiefly at 13,200 volts, but all new construction is based upon the use of 33,000 volts, and existing lines will be changed to the higher pressure as rapidly as conditions will permit. The local distribution is



Figs. 1 and 2—Standard Types of Poles.

effected by single-phase, 2200-volt lines in the smaller towns where there is no considerable demand for motor service and the load does not exceed 50 kw to 75 kw. Three-phase, 2200-volt, three-wire distribution is used in cities where it is required for motor service, and its use will probably be extended to other towns whenever a demand for three-phase motor service may arise. The three-wire system is preferable to four-wire distribution where the distances do not exceed 2 to 3 miles and where the load is less than 500 kw.

Four-wire, 2300-4000-volt distribution is used in and near Chicago where small communities are located within 3 to 5 miles of the main centers of distribution and where large industrial concerns requiring 100 to 500 kw are often located at some out-of-the-way railway junction, necessitating long extensions of distributing lines which would be much more difficult to manage at 2300 volts, three-wire, than they are at 4000 volts. Four-wire distribution will probably also be found useful in some of the better agricultural districts where a demand for motor service and lighting for farm purposes is developed. The scattered nature of such service will necessitate the use of higher voltages than 2200 in many cases.

It is evident to those who are familiar with the size of the towns and cities in this territory that the amounts of energy delivered are comparatively small, and that the engineering problem resolves itself into one of distribution by means of a higher voltage than is usually employed for distribution purposes. The problem is therefore quite different from the ordinary transmission system where the load is delivered at one point in bulk and where the questions of branch lines, fuses, lightning protection, pressure regulation and outdoor substations are not involved.

In 2200-volt distribution a transformer is installed for a group of consumers who are served from a secondary main. The transformer, if installed out of doors, is protected by fuses, and the pressure supplied to it is within a very small percentage the same as that supplied to neighboring transformers. In distributing by 33,000-volt lines the transformer supplies the primary mains of an entire town, with a second transformation down to the lamp voltage. The pressure supplied is nearly the same as that in adjoining towns, but the difference in drop in the primary distributing system of the two towns is quite likely to be so much that an additional element must be introduced, viz., the potential regulator. In locations where there is a substation building the use of automatic regulators takes care of the situation very satisfactorily. Where there is not over 150 kw lighting load the lighting may all be put on one phase, thus requiring but a single regulator. With outdoor installations the problem is not so simple, as the location of an automatic regulator on a pole platform makes it rather inaccessible for inspection and repairs and the exposure to the outdoor air, even though it is well housed, is likely to cause the adjustments to vary and get out of order. However, a weather-proof type of regulator made in small sizes and suitable for erection in the open air has recently appeared, which it is hoped will be found sufficiently reliable to meet the needs of towns requiring outdoor regulators of 7.5 kw to 10-kw capacity.

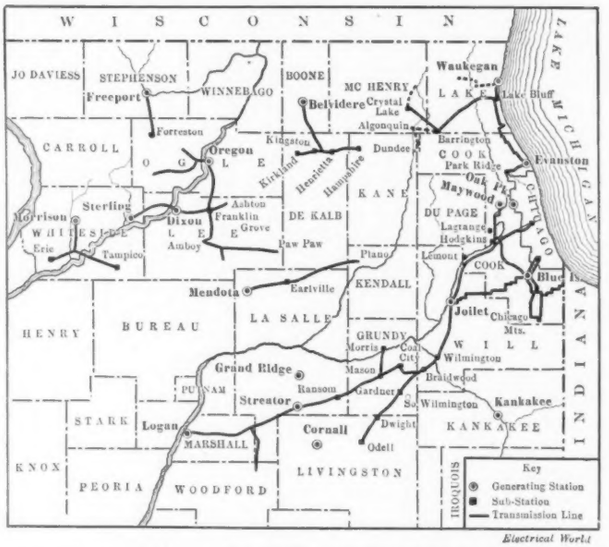
In these earlier stages of development there are some cases where 33,000-volt lines are less than 25 miles long, and where the total load on the lines is not over 1000 kw. Regulation may be satisfactorily accomplished in these cases directly from the generator, as the line drops are not over 3 to 4 per cent and the towns are so small that the drop in the local systems is approximately the same. The 33,000-volt transformer may be installed out of doors where no building is available for it. In sizes up to 75 kw it is desirable to put them out of doors in any event, to avoid bringing the high-tension lines inside the substation building. The protection of 33,000-volt transformers by fuses is a problem which is as yet not wholly solved. A few installations of 25 kw to 50 kw have been made which are protected by the S. & C. type of fuses. The experience which has been had with this fuse thus far seems to indicate that it will be satisfactory for outdoor use up to 150-kw units. Larger sizes of transformers are usually in a substation where circuit-breakers provide necessary protection.

The problem of lightning protection has not been so easily met, as the cost of the average 33,000-volt arrester equipment is nearly as much as for a 50-kw transformer. In the larger substations where room is available the aluminum cell arrester is justifiable, but in the outdoor substations the one thing permissible is a horn-gap with resistance in series.

The first cost of a general transmission-distribution system is naturally rather high per kilowatt of maximum demand in the early years. What is saved in the investment in generating equipment by concentrating the capacity in a few large stations is expended in the erection of the connecting lines. But as the load of new towns along the route is added, and as the development of industrial power proceeds and the use of electricity becomes more general for heating and cooking purposes, the diversity of uses will increase the load-factor and the load to a point where the investment per kilowatt will not be above normal.

UNIFICATION IN NORTHERN ILLINOIS.

As an introduction to his paper on "High-Tension Distribution in Northern Illinois," read at the recent Peoria convention of the Illinois State Electric Association, an abstract of which is printed in another column of this issue, Mr. H. B. Gear made some interesting general observations on the tendency toward the consolidation of electric-service properties, particularly as exemplified in northern Illinois. He remarked that this tendency is the natural outcome of the modern trend toward the consolidation of physical properties and unification of management. Properties which remained undeveloped because of lack of capital and other facilities for aggressive extension work while under local control have become important parts of large organizations when placed under a management with ample capital and a live new-business department. Scientifically adjusted rates which attract large long-hour users and moderate retail charges which make electric lighting popular with all classes of people have been combined with active selling campaigns to produce business for the central stations in these cities, much of which was not in existence under individual management. Thus the increased volume of business, combined



Transmission Lines of the Public Service Company of Northern Illinois and the Illinois Utilities Company, Operating Conjointly.

with various economies of operation, administration and purchase of materials, has made a successful whole out of what was a heterogeneous lot of properties of more or less doubtful value. This has even been done in cases where the properties were so widely scattered as to forbid physical consolidation through a transmission system.

In the groups of towns clustered about the larger cities the economies of unified administration have been generally supplemented by savings effected through the consolidation of power supply. The smaller and less efficient power stations have been discontinued or held in reserve for peak loads only and the main power supply has been derived from stations containing large and efficient units permitting material savings in operating costs. The former stations become substations receiving power from the transmission system and delivering it through transformers to the local distributing system.

In this way, for example, most of the suburban towns within a radius of 30 or 40 miles of the city of Boston are being served from a common transmission system. The towns within a similar radius of New York are being served by the New York and Brooklyn companies and by the Public Service Company of New Jersey. The Pacific Gas & Electric Company has a transmission network larger than

any of these, serving towns in California within a radius of 100 miles of San Francisco. Various other cities where similar developments have been made might be instanced.

In the territory adjacent to Chicago and in northern Illinois the physical consolidation of properties has been in progress for some years on a very extensive scale. Transmission lines have been extended in a northwesterly direction for a distance of 40 to 50 miles, reaching approximately to the Wisconsin state line. In a southwesterly direction the various towns and cities are interconnected by a transmission system extending through Joliet and Streator for a distance of over 100 miles. This system will reach, when lines now under construction have been completed, to Lacon, a distance of about 125 miles from Chicago.

In the section of the State north and west of the Illinois River there are several groups of properties which have been or are now being interconnected by transmission lines as indicated in the accompanying map. This development is quite recent and some of the generating stations which are shown will doubtless be converted into substations as the system is extended. Other connecting lines will be provided as the loads increase, and it requires but a little effort of the imagination to see northern Illinois covered by a network of transmission lines, giving electric service not only in towns which now enjoy it but in many others which have not heretofore been so favored.

CENTRAL-STATION DESIGN.

At a meeting of the mechanical engineering society of the Worcester (Mass.) Polytechnic Institute on Nov. 8 Mr. I. E. Moultrop, mechanical engineer of the Edison Electric Illuminating Company, Boston, gave an illustrated lecture upon the design of large central stations. Mr. Moultrop emphasized the important features of the Edison company's South Boston plant in relation to the trend of the latest designing practice and laid down the principles of desirable arrangement and construction for stations of 30,000-kw rating and over. In the order of their importance he considered the problems of fuel supply, circulating-water supply, cost of real estate, fuel-storage space, boiler-feed supply and transmission-line routes as affecting the station location, and then discussed the details of building construction, coal handling, prime movers and electrical equipment.

In the design of a large station wharf privileges having a channel of ample depth for coal carriers of large size and the avoidance of drawbridge tolls are important factors, and inland plants should as far as possible not be dependent upon a single railroad supply of coal. The coal-storage facilities should permit the hold of at least a month's fuel supply at all times and three months' supply in winter to guard against interruptions. The supply of circulating water should be almost unlimited in a plant of great size. At the South Boston plant with seven units in operation 10,000,000 gal. of circulating water per hour is required to maintain the vacuum. The practice of drawing such water from a channel rather than from shallow places in a harbor is highly desirable. Although the cost of land is not the factor it used to be in connection with large stations on account of the tendency to locate such plants outside the centers of cities, the burden of fixed charges carried by the real-estate investment in plants of very high capacity is a factor to be considered with some care. Although it is always possible to build a plant in a new location when the demand for service necessitates it, it is more desirable to extend a well-located existing station, as this does not require a new operating organization or new coal-storage and wharfing facilities.

Water-tube boilers are the only kind suitable for large stations, and Mr. Moultrop held that units of from 500-hp to 750-hp rating are as large as is desirable. Engineers are not agreed at present regarding the desirability of very high-powered boiler units, although these have made excellent records in the Delray station of the Detroit Edison Company and in European plants. Large boilers complicate the question of spare equipment and are liable to the same troubles as smaller units, so that a larger percentage of the total steaming capacity is taken from service in case of trouble with a boiler of large size. The speaker compared a 2365-hp boiler with one of 550-hp rating, quoting from the report of the prime movers committee of the National Electric Light Association as presented at Seattle last June, and affirmed the belief that the greater flexibility of the smaller units will maintain them in favor for some time.

Discussing coal handling, Mr. Moultrop advised constructing bunkers above the boilers capable of carrying from one and a half to two days' supply of fuel, recommending the storage of the main body of fuel outside the station building. Sole dependence should not be placed upon a single conveyor in feeding a station of great size. The bunkers should be designed to empty automatically and should be entirely dust-proof to protect other parts of the station. Rehandling facilities and sufficient equipment to enable vessels to be unloaded promptly are important. Ash hoppers should have a capacity of at least one and a half to two days' accumulations and should be built of fire-resistant material. Boilers should be placed above a high basement to facilitate handling ashes without recourse to manual labor. Provision should be made for the rapid removal of fuel from the bunkers in case it should become ignited. The best possible material in boiler settings and the highest class of workmanship are essential to economical operation, including liberal chimney and flue areas and the avoidance of long horizontal flues and connections. The ideal mechanical stoker has a good overload capacity, positive air control, operates economically, has few working parts, produces no smoke, and besides having low maintenance costs requires practically no manual labor in its operation. Too often stokers are cramped into the combustion-chamber area. Boiler-feed pumps should not be installed in the boiler house but should be in the care of engine-room or turbine-room attendants, and in large plants two or more city watermains should be supplied.

Except at the yearly peak, a spare turbine unit should be ready at all times for service, and the station should not be crippled by the shut-down of the largest single turbine set in its equipment. The unit system of piping and auxiliary arrangement was commended, with the installation of main and minor piping in a room beneath the boilers, where even temperatures can be maintained without expansion strains. Short piping runs between boilers and turbines are necessary to avoid serious temperature drops in handling superheated steam.

The turbine room should be a one-story affair, with all apparatus possible on the floor, and great care needs to be taken to provide for convenient access to all parts of the equipment, reducing stair climbing to the minimum. In laying out piping, flanges must not be crowded and all valves and joints must be easily reached. It should be possible to isolate and draw off the oil in the lubrication system in case of fire, and every feature of the station building should be of fireproof construction, with due regard to the external hazard. Ample ventilation and natural light, combined with space enough in the turbine room to permit the later installation of larger units without increasing the size of the building, are important points. The provision of a separate operating room with remote-control and locked rooms containing oil switches and busbar compartments was recommended. In closing, Mr. Moultrop emphasized the great importance of not being bound by first cost in the selection of apparatus and urged the preparation of as many preliminary station designs as possible, with the co-operation and criticism of the operating department. In a recent case twenty-five designs were made, but the results justified the effort.

CARRYING CAPACITIES OF RESISTOR WIRES AT HIGH TEMPERATURES.

In a talk before the Lewis Institute Branch, A. I. E. E., Chicago, Nov. 13, Mr. Charles P. Madsen, consulting engineer, Chicago, discussed methods used and results obtained by him in securing data for the tables of carrying capacity of round and flat sections of Nichrome resistor wire recently published by the Driver-Harris Company, Newark, N. J.

The work thus accomplished represents quantitative pioneering in an important field, for, in the absence of knowledge concerning the laws of conduction and carrying capacity at high temperatures, many of the earlier data that appeared, said the speaker, were based only on estimates and improper assumptions, resulting in most cases in wide divergence from the actual facts. Errors of 50 per cent were common, and temperatures were incorrectly stated by 100 deg. or more.

After considering various methods of measuring the hot-wire temperatures for the recent experiments, including the use of electrical pyrometers, thermo-electric couples, method of resistance change with temperature, etc., an optical pyrometer was finally arranged, the temperature of the wire being compared with that of a standard lamp filament calibrated by the United States Bureau of Standards.

The heat energy developed in a wire is dissipated as emissive radiation and by convection. The emissivity of a heated wire is an exponential function of its absolute temperature. Convection, however, is almost independent of size or shape of conductor. The total carrying capacity does not depend upon the cross-section alone, but upon the shape and the surface area per unit of cross-section, so that round and flat wires of identical cross-sectional area have different carrying capacities. The unit intensity at which smaller wires can be worked is much higher than that possible with larger sections. Unit-carrying capacity is thus a variable for various sizes of wire, but may be expressed as a function of temperature, surface ratio and radius of curvature. Although theoretically the carrying capacity of a given wire has no limits, the practical quantity depends upon the conductor's energy-transfer power, as well as upon the upper limit of temperature which the material can withstand. Mr. Madsen exhibited tables and curves comparing the carrying capacity of round and flat sections for various cross-sectional areas. These showed that the ribbon sections dissipate the heat produced faster than the ordinary round wires, although the termini of the curves revealed that the ribbon sections ultimately failed by "dropping" at lower temperatures than the round sections.

FUEL TESTS ON INTERNAL-COMBUSTION ENGINES.

Over 2000 tests were conducted by the Technologic Branch of the United States Geological Survey at St. Louis, Mo., during 1907 and 1908, to determine the comparative value of gasoline and alcohol as fuel for internal-combustion engines. The results of these tests are now presented in a thirty-seven-page pamphlet issued by the Bureau of Mines, Department of the Interior, prepared by Mr. Robert M. Strong. The author considered the subject from the standpoints of differences in engines, effects of fuel quality, influence of different operating conditions and other factors affecting fuel consumption. A synopsis of the results is presented in a series of twelve conclusions, a few of which are herewith stated. The low heating value of completely denatured alcohol will average 12,500 heat units per pound, or 71,900 heat units per gallon. In comparison with this the low heating value of gasoline, having a specific gravity from 0.71 to 0.73, will average 19,200 heat units per pound, or 115,800 heat units per gallon. Thus the low heating value of a pound of alcohol is approximately six-tenths of the low heating value of a pound of gasoline, and a given weight of gasoline requires approximately twice the weight of air for complete combustion as the same weight of alcohol. Explosive mixtures of alcoholic vapor and air can be compressed at much higher pressures in an engine cylinder without pre-igniting than mixtures of gasoline vapor and air. A gasoline engine which has a compression pressure of 70 lb. but is otherwise as well suited to the economic use of denatured alcohol as gasoline will give about 10 per cent more available horsepower when using alcohol. Gasoline and alcohol engines of similar construction and having degrees of compression best suited to the fuel employed will require as a rule equal volumes of gasoline and denatured alcohol respectively per brake hp-hr. Gasoline engines of the usual 4-cycle stationary type will ordinarily consume about 1 lb. of gasoline per brake hp-hr. at or near the rated load and with a reasonably favorable adjustment of the mixture quality and the time of ignition. The relative fire hazard involved in the storage and use of denatured alcohol appears from statistics to be very much less than the hazard from gasoline and possibly less than that from kerosene. Progress in the United States in developing alcohol engines has been slow.

FUEL-OIL PRODUCTION AND CONSUMPTION IN THE UNITED STATES.

The statistics compiled by the United States Census Bureau on the production and consumption of oil, published in the report of the thirteenth census, are of considerable interest to users of internal combustion engines. Crude petroleum is the common source from which naphtha, gasoline, kerosene and the heavier oils are obtained, by the process of fractional distillation.

During the past decade the crude petroleum used has increased in quantity from 52,011,005 barrels of 42 gal. each in 1899 to 120,775,439 barrels in 1909, or 132.2 per cent, and the refined-oil products aggregated 40,290,985 barrels of 50 gal. each in 1899, 46,454,062 barrels in 1904, and 89,082,810 barrels in 1909, an increase for the decade of 136.2 per cent.

The largest gain was that in the output of fuel oils, which increased from 7,209,428 barrels in 1904 to 34,034,577 barrels in 1909 as the result of the increase in the refining of low-grade crude oils. The accompanying table, taken from the report above mentioned, shows the increase in production and the variation in price of the four most common petroleum products during ten years.

DATA ON PETROLEUM AND ITS PRODUCTS, 1899-1909.

	1909.	1904.	1899.
Crude petroleum used:			
Barrels (42 gal.)	120,775,439	66,982,862	52,011,005
Cost	$152,307,040	$107,487,091	$80,424,207
Price per gallon	3.01 cents	3.85 cents	3.70 cents
Oils—			
Illuminating:			
Barrels (50 gal.)	33,495,798	27,135,094	25,171,289
Value	$94,547,010	$91,366,434	$74,694,297
Price per gallon	5.70 cents	6.73 cents	5.92 cents
Fuel (including gas oils):			
Barrels	34,034,577	7,209,428	6,095,224
Value	$36,462,883	$9,205,391	$7,550,664
Price per gallon	2.11 cents	2.57 cents	2.48 cents
Lubricating:			
Barrels	10,745,885	6,298,251	3,408,918
Value	$38,884,236	$23,553,091	$10,897,214
Price per gallon	7.42 cents	7.46 cents	6.45 cents
Naphtha and gasoline (inculding gas naphtha):			
Barrels	10,806,550	5,811,289	5,615,554
Value	$39,771,959	$21,314,837	$15,991,742
Price per gallon	7.36 cents	7.34 cents	5.71 cents

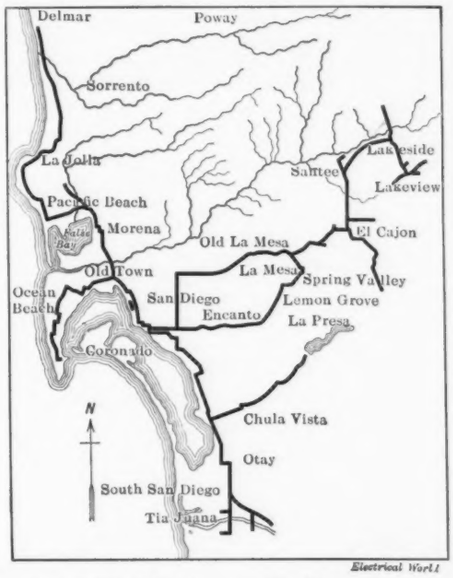
Central Station
Management, Policies and Commercial Methods

ELECTRICAL PAGE AT TWIN FALLS, IDAHO.

The commercial department of the Great Shoshone & Twin Falls Water Power Company, Twin Falls, Idaho, once a month publishes an electrical page in the Twin Falls *Times*. The material is very similar to that in the electrical pages published in the larger cities in the East, the page being devoted entirely to electrical advertising and reading matter. The issues in which the page appears are mailed to all consumers and prospective customers of the company in the eighteen different towns and cities reached by its circuits. The return from the sale of advertising is sufficient to pay the cost of printing the page, and contracts for certain specified amounts of space are made with each advertiser on a yearly basis. The results thus far have greatly exceeded the expectations of the company, and, judging from the general interest displayed, this form of advertising has been most profitable. The electrical page published by the Great Shoshone & Twin Falls Water Power Company is the first of its kind to be started in the inter-mountain region, if not the first west of the Rocky Mountains. To Mr. E. A. Wilcox, the commercial agent of the company, this innovation is due.

TRANSMISSION LINES IN THE SAN DIEGO DISTRICT.

Illustrating the growth of an up-to-date electric-service company, the accompanying map of the 11,000-volt lines of the San Diego Consolidated Gas & Electric Company of San Diego, Cal., is interesting. The city is growing rapidly, and the company, which is controlled by H. M. Byllesby &



Map Showing 11,000-Volt Lines of the San Diego Consolidated Gas & Electric Company.

Company, is growing with it. The suburbs are keeping pace with the city. To serve the field, the company has constructed many miles of 11,000-volt electric transmission lines and high-pressure gas mains. Shown on the map are 101 miles of 11,000-volt electric transmission line serving communities from Delmar, 20 miles north of San Diego, to Tia Juana, just this side of the Mexican border, 16 miles on the south, and to Lakeview and Lakeside, 22 miles northeast.

The map shows only the high-tension electric extensions. At the present time the San Diego Consolidated Gas & Electric Company owns a total of 343.9 miles of gas mains, which include the high-pressure extensions, and 1530 miles of electric lines, which include the high-tension electric extensions to the suburbs and surrounding towns. Extensions are under way at the present time to a number of other communities, and the company does not lose time in securing possible business. The population of the city of San Diego as given by the 1910 federal census is 39,578. The total population served by the San Diego company at the present time is approximately 64,500. As an indication of the company's increased business, the electric output for the week ended Oct. 18 was 301,440 kw-hr., which shows a gain of 45 per cent over the corresponding week of last year.

LEASED PRIVATE OPERATION OF A MUNICIPAL PLANT.

The electric-lighting system of Emporia, Kan., at one time owned by the local combination gas company, was purchased by the city nearly fifteen years ago. For thirteen and one-half years it was then operated as a municipal plant, following which, in April, 1911, it was leased by a private syndicate which now operates it. During the period of its service as a city undertaking the property was managed by the same man who has since been in charge for private capital, so that an excellent opportunity is here afforded to compare the limitations and advantages of municipal and corporate operation, assuming the important factor of managerial skill and acumen to have remained practically constant throughout both periods. In fact, the former Emporia situation was an example of the best conditions of municipal operation, wherein a capable manager was retained in his position throughout the terms of three different political parties and the operating force did not fluctuate with varying political fortunes.

The Emanuel syndicate of Dayton, Ohio, now leases the Emporia power plant and distribution system for a yearly rental of $3,400, which is 5 per cent of its appraised value, $68,000, at the time it was taken over, April 11, 1911. This inventory was made by a board composed of Prof. B. F. Eyer, of Manhattan, Kan., and Mr. M. Dunsworth, manager of the Emporia property for the past fifteen years. The valuation applies only to the power plant and the existing distributing system. The lease is for twenty years, at the end of which time the company agrees to turn back to the city an equal valuation in modern up-to-date equipment, the likelihood being, of course, that in the meantime all the present apparatus will have become obsolete and have been replaced. The question of renting the plant and abolishing municipal service was voted upon by the people of Emporia and the proposition thoroughly approved before action was taken.

Since taking over the property the tenant company has expended $55,000 in improvements at the generating station, including the installation of a 500-kw steam turbine. The existing municipal equipment comprised one 150-kw and one 360-kw engine-driven alternator and four 150-hp boilers. The larger engine set is now being operated regularly with the turbine. Extending the distribution system by more than 100 per cent of its former scope, many new lines have been opened up to outlying territory and new customers taken on who have long clamored for service.

Emporia, a city of 10,000, had 700 users of electricity when the municipal plant closed shop. Now, eighteen months later, there are 1300 customers. Power business has also been added and a good day load secured. At the present time, according to Mr. C. A. Bergen, contract agent, the Emporia plant has a larger output per capita than any other station in Kansas.

Such extensions as were made in the days of municipal ownership had to be met out of the electric-lighting fund and were consequently few and small, despite the fact that no depreciation or interest was ever charged against the equipment investment. Money was always hard to get, and even after funds had been appropriated, action and authorization from the various citizens' committees were slow and tedious to obtain. A bond issue of $30,000 was floated in the early days of city working, and this was used to defray cost of some new engine sets, etc.

For its municipal plant the city was never, of course, able to solicit new business, so that it was inevitable that local electrical development stagnated. Now an attractive downtown office is maintained, an aggressive new-business manager is employed and the company advertises extensively by newspapers, billboards and direct appeal. A six-car street-railway service has been inaugurated, and the principal streets are lighted with a "white way" formed by bracket lamps attached to the trolley posts. Under its contract with the city the rate for lighting service remains the same as under municipal operation, 10 cents per kw-hr., with $1 minimum per customer.

Summing up, twice as many customers are now being reached with the comforts and conveniences of electric light; new industries are being encouraged to locate and buy energy; the municipality is receiving an assured 5 per cent return on its investment instead of floating bond issues, and since the stimulus of progressive private operation has been applied the little city made famous by William Allen White has altogether become a brighter and more attractive place to live.

CLASSIFIED COMPARISON OF RATES.

The Grand Rapids-Muskegon Power Company has made a comparison of the rates charged for central-station service in thirty different cities, from the data prepared by the companies in each city, for certain classes of installations. The method of making the comparison was similar to that followed by the N. E. L. A. rate research committee in 1911 for certain classes of installations in the thirty-six largest cities in the United States. The average rates found in the present instance are presented in the accompanying table.

AVERAGE RATES FOR CENTRAL-STATION SERVICE IN THIRTY CITIES.

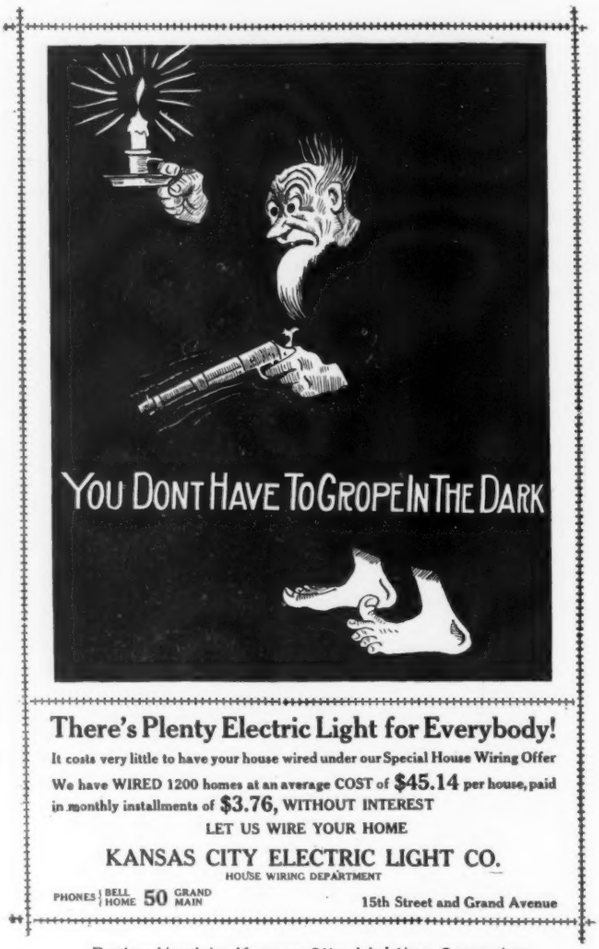
Installation.	Connected Load, Kw.	Maximum Demand, Kw.	Monthly Consumption, Kw-hr.	Average Rate per Kw-hr., Cents.
Residence, large	3.0	2.2	127	9.1
Residence, small	0.6	0.5	27	9.4
Retail store, large	7.0	7.0	1126	6.3
Retail store, small	0.5	0.5	67	8.1
Drug store	1.5	1.5	200	7.4
Saloon	1.5	1.5	377	6.35
Church	5.0	5.0	156	8.7
Industrial, one motor	1.49	2.0	109	6.6
Industrial, two motors	3.7	5.0	286	6.0
Industrial, three motors	10.3	10.0	244	6.7
Industrial, eight motors	18.7	25.0	3318	3.2
Industrial, twenty motors	59.7	50.0	4180	3.5

Out of the total of thirty cities, there was one having a population of less than 25,000, nine with populations between 25,000 and 50,000, eight between 50,000 and 100,000, seven between 100,000 and 200,000, four between 200,000 and 500,000, and one in excess of 1,000,000 population.

CENTRAL-STATION ACTIVITY IN KANSAS CITY.

New customers are now being added to the Kansas City Electric Light Company's lines at the rate of a thousand or more a month, the meter settings having recently run as high as 1500 in thirty days. Fears for the failure of the natural-gas supply are held to be in part responsible for the present landslide toward electric service. A similar effect is felt in the industrial field, where about 20,000 kw in motors is awaiting connection to the company's lines. To the interruption of the industrial natural-gas supply is added the effect of the action that has been taken by the oil dealers in refusing to furnish any more fuel oil for local isolated plants.

Advantage of the present apprehension about the gas-lighting supply has been taken by the Kansas City Electric Light Company to do some clever advertising, an example of which is reproduced herewith. These pictures have been used on cards mailed to local gas users and posted in display windows, and their humorous quality has created much amusement.

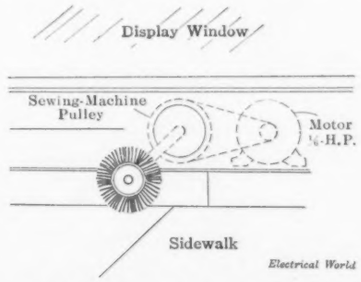

YOU DONT HAVE TO GROPE IN THE DARK
There's Plenty Electric Light for Everybody!
It costs very little to have your house wired under our Special House Wiring Offer
We have WIRED 1200 homes at an average COST of $45.14 per house, paid in monthly installments of $3.76, WITHOUT INTEREST
LET US WIRE YOUR HOME
KANSAS CITY ELECTRIC LIGHT CO.
HOUSE WIRING DEPARTMENT
PHONES BELL HOME 50 GRAND MAIN
15th Street and Grand Avenue

Poster Used in Kansas City Lighting Campaign.

Since April 1, 1911, the old-house wiring campaign already referred to in these columns has been progressing rapidly, 1350 houses having been wired in about eighteen months. For this entire number, according to Mr. C. F. Farley, contract agent, only sixty-seven extensions were required. Six solicitors are employed and contracts are now averaging fifty a week, although recently in one week a record of sixty-nine was attained. Half of the contracts closed during the entire campaign have been taken in the last six months. The average cost per house has been $45.14, the contracts providing that this sum shall be paid in monthly instalments of $3.76.

MOTOR-DRIVEN SHOE CLEANER AS WINDOW ATTRACTION.

An up-to-date cleaning establishment in Peoria, Ill., has a rotary shoebrush installed out on the sidewalk just beneath its display window, so that pedestrians can flick the wayside dust from their footgear while they look into the window. This shoebrush has become very popular and is in use almost continuously, many people walking around this way, a block off the main street, to have their shoes dusted in a twinkling by machinery. As the 1/6-hp motor which drives the duster runs daily from 6 a. m. to 10 p. m., it provides a desirable long-hour load for the central-station company, which also operates all the machinery of the establishment.



Motor-Driven Shoe Duster for Public's Use.

The rotary brush used is one of the kind employed on electric shoe-repairing machines. It is driven through a 14-in. pulley taken from a sewing machine belted to the motor, which runs at 3400 r.p.m. The Ideal Laundry Company, which has the installation, considers the duster a valuable advertisement for its general cleaning business.

ELECTRICITY VS. GASOLINE IN WOOD SAWING.

Something more than a year ago the Red River Power Company, Grand Forks, N. D., succeeded in inducing the Fairchild Fuel Company to install an electric motor for the operation of a saw, displacing a gasoline engine. Recently the electric-service company received a letter from the fuel concern comparing the cost of operation by electricity with the cost of operation by gasoline. The letter contained the following figures:

The cost of gasoline from Sept. 5, 1910, to Sept. 5, 1911, was $57.48 and repairs and batteries cost $60.65, a total of $118.13. The average cost of the gasoline was 15 cents a gallon. The amount of wood sawed was 905 cords at a cost of 13 cents a cord. Electricity was used from Sept. 5, 1911, to Sept. 5, 1912, at a cost of $88.25. Repairs, fuses and brushes cost $9.46, a total of $97.71. In this case the amount of wood sawed was 1178 cords, the average cost being 8.4 cents a cord. The comparison shows that the fuel company was able to saw 30 per cent more wood and at the same time was able to effect a reduction of 35 per cent in unit cost.

IMPORTANCE OF THE SMALL-RESIDENCE CUSTOMER.

A new-business manager who has been directing special attention to getting house-wiring contracts from the humbler homes in his community points out the exemplary advantage of first securing this class of customers rather than the wealthier residents. While the more pretentious dwellings insure a greater income, they fail as examples in getting other residence business because, if anything, they contribute to the suspicion felt by those in medium circumstances that electricity is an expensive luxury.

On the other hand, the wealthy woman who sees electric service installed in the house of a poorer neighbor is at once convinced that she can afford electric light if her less prosperous acquaintance can. As a result the large houses come easily into the electric fold, and the central station thus gets all the business. It is to the small customers, therefore, that attention and effort should be directed. This class requires more of the salesman's time, for indirectly the results obtained are of double value.

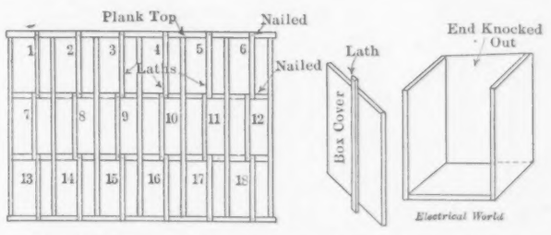
KENTUCKY ELECTRIC COMPANY'S DEMONSTRATIONS OF DOMESTIC APPLIANCES.

Since the opening of the Kentucky Electric Company's new building, noted on page 998 of our issue of Nov. 9, a specialty has been made of the demonstration of household appliances, the entire first floor being given over to this feature. Small rooms furnished in the most approved style and separated from each other by Mission railings are used to simulate the modern home, and in each room from parlor to kitchen are installed electrical appliances of every nature. The visitor is welcomed and conducted through the entire house, a demonstration being made of as many of the appliances as practicable. The president of the company, Mr. Robert E. Hughes, recently gave a series of "electric luncheons" to the stockholders of the company and other invited guests, at which all of the viands were prepared in the electrically equipped kitchen. In the near future the company plans to give a series of lectures, illustrated with motion pictures, in the assembly hall of the building to demonstrate to classes of business men the commercial and industrial uses of electrical energy.

STORING FANS FOR THE WINTER.

For the dust-proof storage of his rental fans during the winter months, Mr. J. T. Skinner, manager of the Lawrence (Kan.) Railway & Light Company, has had one end knocked out of each of a number of the shipping boxes in which the fans were received. The open boxes are then assembled in piles, like sectional bookcases, and fastened together by nailing plasterers' laths across their backs. A piece of wood planking forms the top of the group as shown. The covers are meanwhile prepared by nailing lengthwise on each a piece of lath cut just long enough to be tacked onto the box sides, to hold the cover in place. Arranged in this way, any cover of the lot can be removed easily to inspect the fan within.

Accompanying the box storage shelves a card index has been prepared locating each fan by the number of its container, and giving details of the fan's nameplate, location where last used, when returned, when wanted again, parts missing, condition, repairs necessary, etc. Referring to this index, parts can be ordered in advance, and during bad winter weather the outside men's time will be utilized in making the fans ready for the coming season.



Shipping Boxes Arranged for Winter Fan Storage.

Wiring and Illumination

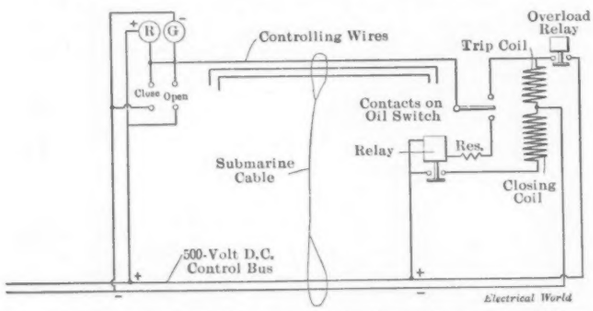
BYLLESBY COMPANIES ADOPT UNIFORM METHOD OF GROUNDING.

All managers of H. M. Byllesby & Company properties engaged in the production and distribution of electricity who have not already made a practice of grounding the secondary circuits of transformers were requested recently to make proper and workmanlike ground connections on secondary circuits where the potential of such circuits does not exceed 250 volts. According to the circular letter of instructions sent out, all ground connections must be made at the poles where the transformers are installed and not within the building of the customer, nor shall the service switch either on the customer's side or on the service side be connected to ground. Secondary circuits over 1000 ft. long must be grounded every 1000 ft. The ground connection is made by driving a ¾-in. galvanized iron pipe at least 5 ft. into the ground at the base of the pole, and more than 5 ft. if permanent moisture is not obtained at that depth. To the top of this pipe is secured, by means of Babbitt metal poured into the pipe and extending therein 8 in., a piece of No. 6 gage BB puddled iron wire. This connection is extended up the pole, the wire being secured by staples at intervals of 3 ft. For a distance of 7 ft. from the ground the ground wire is protected by a piece of heavy molding. All single-phase, two-wire secondary circuits are required to be connected to ground on one side of the circuit, and all secondary three-wire circuits are to be grounded at the neutral wire. All multiphase secondary circuits must be grounded from the neutral point of the phase connections.

REMOTE-CONTROLLED SWITCHING SUBSTATION.

Across the Illinois River from its Peoria generating station, the Peoria (Ill.) Gas & Electric Company is building a switching and transformer substation which will be controlled entirely through a submarine cable from the operating switchboard in the main plant. A single 13,000-volt, three-phase transmission circuit, already built, crosses the river on a railroad bridge, and from this it was desired to feed three separate circuits on the far side. No space was available for additional lines on the bridge, and submarine cables were objected to, so that the only remaining course was to locate the switching station across the stream, extending its control circuits back to the main switchboard.

An ingenious circuit arrangement has been devised in the



Circuit for Controlling Through Oil Switches Over Five Wires.

factory of the manufacturer of the switches, the Westinghouse company, by which all three oil switches can be individually opened and closed and have their positions reported at all times, using only five wires in the control cable. In the accompanying sketch are shown the operating circuits of a single switch. The oil-switch arm is provided with telltale contacts which report its position, whether open or closed, by lighting lamps at the main control board. Energy for these lamps is fed through the coils or relay windings, but the current taken by the lamps is, of course, not sufficient to operate the coils. To open or close the oil switch, the proper actuating contact is closed only momentarily. The "closing" position first operates the relay, which completes the circuit to the closing coil. The "opening" position directly completes the trip-coil circuit. The latter is also connected to the overload relays associated with the series transformers, so that in case of overload the switches open automatically. The oil switches are of the Westinghouse toggle solenoid-operated type and are rated at 100 amp, 13,200 volts.

WIRING FOR RAILROAD BUILDINGS.

A committee of which Mr. A. J. Farrelly, of the Chicago & Northwestern Railway, was chairman presented a report on the installation of wiring for electric service in railway buildings at the recent convention of the Association of Railway Electrical Engineers. Some general recommendations and suggestions were offered in relation to the wiring of eight classes of railway buildings as follows: First, roundhouses; second, machine shops, boiler rooms and engine rooms; third, storerooms, oil rooms and oil-storage rooms; fourth, coal sheds and coal chutes; fifth, cinder and ash pits; sixth, passenger stations; seventh, passenger-station platforms; eighth, freight stations.

In the case of roundhouses it was recommended that all wiring be installed in conduit to be carried either upon the outside or inside of the outer wall. For general illumination in roundhouses it was recommended that use be made of some type of head-lamp reflectors, placed upon the outer wall in the locomotive stalls and approximately 8 ft. to 12 ft. above the floor.

For machine shops complete conduit construction for both lighting and motor-service wiring was recommended. Wiring for motors should be run in conduits under the floor, and a separate circuit should be run from the panel box to each tool. All motors of over 5 hp should be provided with starting apparatus having overload and no-voltage attachments. In no case should two or more motors be controlled by the same fuse. It was also recommended that the rating of all fuses and panel boxes on motor circuits be 25 per cent more than that at which the overload switch at the motor is normally set.

Brief recommendations were made in the cases of the other classes of structures enumerated, and a form of estimate sheet was given, with a typical list of materials, to be used in installing the wiring in any ordinary railway building. Mr. Farrelly explained that this estimate sheet was obtained from Mr. W. J. Eck, electrical engineer of the Southern Pacific Railway.

In the discussion a number of practical points were brought out. Mr. Farrelly favored the use of receptacles on machine tools for attaching plugs for portable lamps, doing away with drop cords. Another delegate recommended the use of single-pole circuit-breakers for each machine tool, doing away with fuses. There was some discussion as to the best method to be adopted to provide for changes in the position of machines. Mr. Pastorius thought it better to provide several centers of distribution for one shop of considerable size rather than one panelboard. This provides more flexibility in making changes in wiring and in moving tools and adding new tools. He also said that he thought open wiring was all right.

Mr. Andreucetti, of the Chicago & Northwestern, objected to open wiring in any railroad shop. He advocated one center of distribution, with a steel cabinet and provision for sufficient circuits to care for extensions. One objection to open wiring, he said, was that the average electrician or

handy man does not usually make a good job of electrical connections. With conduit a skilled electrician is required. Mr. Pastorius explained that he didn't believe in open wiring himself as a rule, but the main feeders should be accessible with ease in making changes. Under shop management the work can be done in a competent manner. Mr. Collett suggested a loop system of wiring running around the whole shop, all the wiring to be in conduits, no individual panel-boards being provided. Another delegate advocated the use of distributing panels for groups of motors.

Mr. C. R. Gilman, of Milwaukee, brought up the subject of accumulation of water from condensation or otherwise in vertical conduit pipes used in roundhouse wiring. Others had had some trouble from this cause, and as a preventive it was suggested that holes be drilled in pipes for drainage or else that the conduit be embedded in concrete or attached to wooden posts.

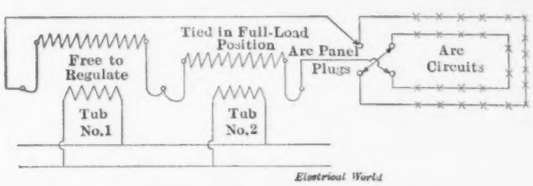
In roundhouse lighting, also, it was pointed out that there is objection to the use of conduits on the roof, as there are apt to be leaks where the taps go through the roof. One gentleman said that the life of conduit in roundhouses is from three to five years, and he therefore advocated open wiring for this class of work. Others said that if the conduit was placed carefully to avoid as far as possible fumes from locomotive stacks and if it was painted occasionally it would last indefinitely.

Another assertion made was that arc lamps are not practicable for roundhouse lighting, as the fumes attack the mechanism of the lamps. However, this view was opposed by other engineers, who say they use nothing but arc lamps in roundhouse lighting and believe that the flame arc, in particular, is the solution of the problem.

In relation to machine-shop lighting several speakers noted with approval a tendency to do away with localized lamps. There is a temptation to use a portable lamp unnecessarily if it is available. Others, however, disagreed with the idea that portables on each machine tend to encourage unnecessary use of electricity for lighting. Mr. Farrelly said that the plug, cord and lamp of a portable set should be kept in the tool room and used only on requisition, being returned to the tool room when no longer needed.

OPERATION OF TUB-TRANSFORMER SECONDARIES IN SERIES.

At one of the Omaha company's substations it happened that there was a long and heavily loaded 6.6-amp inclosed-arc circuit, and near by another similar circuit very much underloaded. From the position of the lines and the streets they served, it would have been inexpedient to transfer lamps from the heavily loaded circuit onto the shorter one. The simplest connection, therefore, seemed that of plugging the two circuits in series at the board and feeding the pair from their 30-kw constant-current transformers



Operation of Constant-Current Transformers in Series.

similarly connected in series. After some misgivings, this was successfully accomplished, and the two tub transformers now pull along together without any signs of trouble. In connecting up these transformers with their primaries in parallel and their secondaries in series it was quickly found that identical polarity arrangements must be preserved throughout. With the two tubs free to regulate separately, objectionable hunting occurred. A slight change in the external circuit would cause unequal compensation in the two units, and then both would oscillate in supplemental fashion, giving poor regulation. This "hunting" was finally avoided by tying the floating-coil system of one firmly in full-load position, depending on the regulation of the other to control the circuit. A similar scheme has since been applied to the test transformers in the company's lamp-test department, when heavy series loads are to be carried.

PROPOSED STANDARDIZATION OF STREET-LIGHTING FIXTURES IN CHICAGO.

A select committee of the Chicago City Council presented a report recently recommending the adoption of an ordinance providing for a uniform design of posts and fixtures for electric street lighting in Chicago. The proposed ordinance would include posts for commercial incandescent street lighting as well as for arc lighting, the posts for the latter to be of different designs in the "downtown" and outlying districts. The posts for commercial incandescent street lighting, as proposed, would be such that the center of the lowest globe would be 16 ft. above the level of the curb. This is considerably higher than the present practice in Chicago in relation to curb lighting. However, before the Mayor signed the ordinance, the vote by which it was passed was reconsidered, and the matter has been referred back to the committee to include both gas and electric-light street lamp-posts; and while the committee is considering the whole subject it is possible the proposed design for curb-lighting posts may be altered.

COMBINATION "WHITE-WAY" AND TROLLEY POLES AT LINCOLN, NEB.

One of the first installations of combination trolley poles and "white-way" fixtures made was at Lincoln, Neb., where 150 such posts are now in use in the business district. The 20-ft. tubular steel poles are equipped with ornamental base

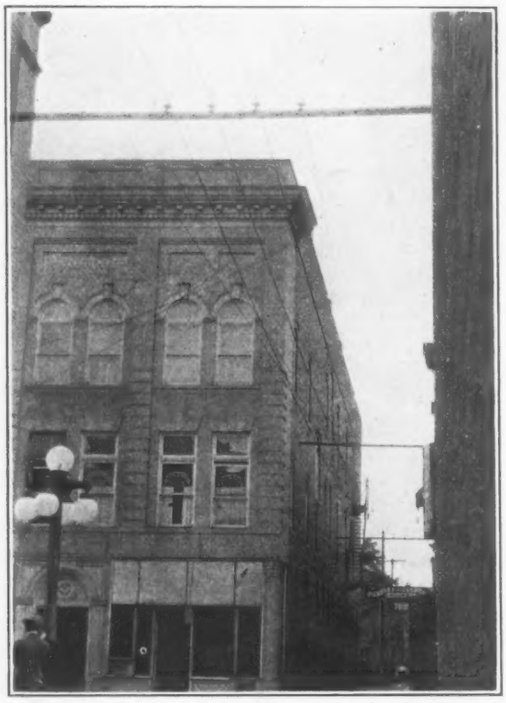
Combination Trolley and Lamp Posts of Lincoln, Neb.

sleeves over their lower 8-in. sections and have four 2.5-ft. arms bolted onto the 6-in. upper standards, at a height of 10 ft. above the curb. Each 30-in. scroll-supported arm carries a 60-watt tungsten lamp, the arms making 45-deg. angles with the curb, so that the four lamps of each post form squares parallel to the building line. The trolley poles are set without rake, and the lamp arms have been care-

fully leveled, so that the effect is very attractive. The underground system was installed, however, using rubber-covered wire pulled through duct to 8-in. square outlet boxes at the foot of the poles—an effort at economy which has since given much trouble, necessitating reconstruction of some sections. Completely equipped the installation cost $84 per post, the expense of the trolley poles being met by the Lincoln Traction Company, whose spans they support. Heavy breakage of lamp filaments has been suffered with this Lincoln installation, but such results are probably traceable to other causes in addition to the vibration caused by trolley-pole impacts, etc. This cluster system is operated from the Lincoln municipal electric-light plant.

IRON-PIPE ALLEY CONSTRUCTION.

Extensive use of iron pipe for cross-arms and other pole-line structures is made by the Muncie and Marion (Ind.) properties of the American Gas & Electric Company. An



Cemented Iron-Pipe Arms in Alleys.

account of this construction with illustrations was given in the *Electrical World* of June 15, page 1316. The accompanying illustration shows the neat and economical iron-pipe alley construction used about the public square at Hartford City, Ind. Second-hand 3-in. gas pipe is cut to length, painted inside and out by dipping and cemented into the brick walls of the opposite buildings, at a height of 18 ft. to 20 ft. above the ground. Two such supports per block suffice to carry the three No. 0 wires with the No. 2 neutral, giving spans of 150 ft. to 175 ft. The insulators are fixed to the pipe with wagon-bale clamp pins as described in the foregoing article. Where there are no brick buildings, temporary wooden poles can be erected to carry one or both ends of the pipe. Adjoining property owners have generally expressed preference for the concreted pipe construction rather than having poles set in the alley, and they gladly grant permission for the necessary holes in their brick walls. If permission is withheld, however, a pole is set. The pipe installation is also considerably cheaper, since a single lineman or troubleman can complete a job in a few hours without outside help.

INDIRECT LIGHTING OF A SMALL CITY CHURCH.

For the improved lighting conditions which are beginning to be noticed and encouraged in church edifices throughout the land the general religious body is largely indebted to certain enterprising denominations whose places of worship have been characterized by all that is most modern in con-

Fig. 1—1200-Watt Indirect Ceiling Fixture in Main Auditorium.

struction and equipment. A faith of good cheer and happiness should certainly have in its temple a high degree of cheerful illumination. Furthermore, the comfort of a congregation can be augmented by careful application of those illuminating-engineering principles which contribute to the protection and conservation of vision.

A complete scheme of indirect lighting has been used throughout the new hundred-thousand-dollar structure of the First Church of Christ, Scientist, at Lincoln, Neb., with the exception of a few bracket fixtures which mark stairways, etc. The main auditorium measures 80 ft. by 100 ft., its central section being a vaulted arch 50 ft. wide and 40 ft. high, from the crown of which are suspended four

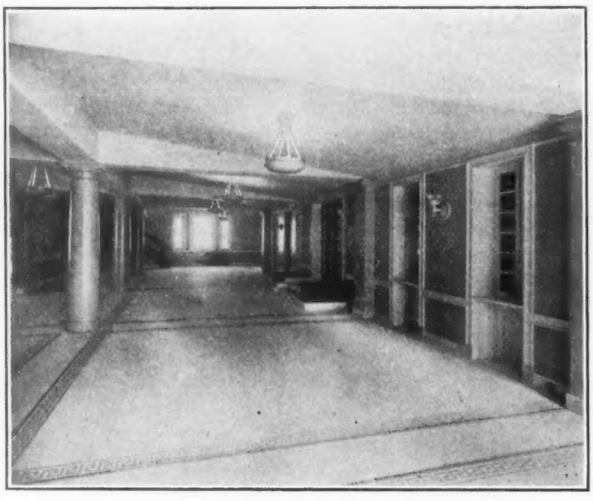


Fig. 2—Indirect Lighting of Church Foyer.

elaborate ivory-bowl indirect fixtures, each containing eight 150-watt tungsten lamps in X-ray reflectors. The links of the chains which suspend these 4-ft. fixtures 10 ft. below the ceiling are also dull, ivory-finished like the bowls, reducing high lights and sources of glare to a minimum. All ceiling surfaces throughout the building are of dull white, diffusing the reflected light. Side walls and trimmings are

tinted an appropriate buff yellow. The pew furniture is of walnut, and the heavy pile of the carpet is deep brown in tone. The central arched ceiling is borne on eight buff Corinthian columns which mark off the side ceiling panels, at the center of each of which is a 36-in. ivory fixture similarly ornamented to correspond to the central units. Each side fixture contains three 100-watt tungsten lamps.

Exits at each of the four corners of the main auditorium and at the center of the room lead down to the entrance corridors and foyer on the mezzanine floor. Severely plain 30-in. indirect fixtures, devoid of all ornamentation, light these 100-ft. by 15-ft. corridors. Each fixture contains three 60-watt tungsten units in E-60 reflectors, and the bowls are suspended 30 in. below the 12-ft. ceiling, which is cream in color. There are six fixtures to each 100-ft. corridor, while each of the panels of the connecting foyer has a similar indirect unit. Both the women's and the men's retiring rooms just off the foyer are also lighted by the indirect system. Beneath the main auditorium is the Sunday-school room, a few steps below the entry mezzanine level. This classroom contains nine indirect fixtures, each equipped with a single 150-watt lamp.

Flanking each of the two entrance doorways is a pair of 6-ft. white molded concrete lamp-posts carrying 100-watt lamps in 16-in. frosted balls. The posts weigh 700 lb. each, and their classic design harmonizes well with the stately row of columns ornamenting the front of the building. In the doorways semi-indirect inverted dome units are employed, each containing one 60-watt lamp. After the indirect corridor installation had been made, it was discovered that persons passing down two of the stairways could look over and into several of the bowl fixtures. As this arrangement was quite unavoidable, protection has since been secured by covering each bowl with a ground-glass cover which diffuses the direct rays of the filaments.

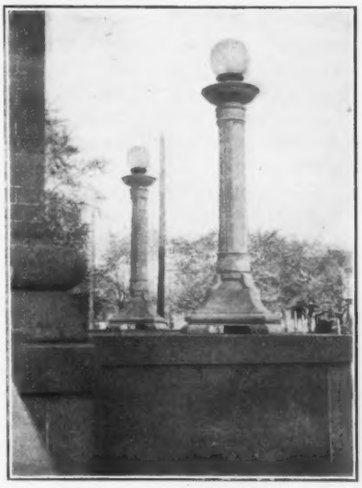


Fig. 3—Molded Concrete Entrance Standards.

Control of the main auditorium lighting is centered in a Crouse-Hinds twelve-circuit panelboard at the left and rear of the reader's rostrum. There is one switch to each 1500-watt arch fixture and to each pair of side units. The corridor lighting is controlled from a six-circuit box in the foyer. Besides the use of electricity for illumination of the church, the organ blower is to be motor-driven and there is a 2-hp motor for the ventilating and heating systems and a ¼-hp vacuum-cleaner motor. Mr. W. C. Howard, of Lincoln, installed the electrical equipment.

RECENT TELEPHONE PATENTS.

REPEATERS.

Among the many attempts to solve the telephone repeater problem is the mechanically driven twin generator. This idea has been developed along many different lines, but usually takes the form of two synchronously driven generators, the output of which is made to vary in proportion to the received telephone current. Such is the repeater of Mr. L. W. Southgate, of Worcester, Mass. He uses two polyphase generators with stationary windings and synchronously driven inductors. One of the field windings, so to speak, of each generator is connected to the corresponding branch of the through telephone line. The exciting coils of the two generators are fed with a constant current and are so arranged that when the magnetization remains constant there is no output to the telephone line from the generator. When, however, the field of either generator is disturbed by an incoming telephone current the magnetic balance is upset and the corresponding generator produces a current like that from the telephone line, but amplified.

Another repeater patent is that granted to Mr. C. B. Morris, of Washington, D. C. This repeater is of the micro-telephone type. It has for its main feature the lining of the repeater casing with a conducting metal shell to prevent effects from extraneous magnetic fields.

IMPROVED TELEPHONE INSTRUMENTS.

The metal-shell receiver has had a good deal of attention of late, most of the patents issued relating to details of construction. Such is the patent granted to Mr. J. Halldon, Elyria, Ohio. This patent deals chiefly with the method of securing the thin sheet-metal ear-cap piece to the thin sheet-metal body piece. According to this invention, a loose ring externally threaded is adapted to slip over the small end of the body piece, an internal lip engaging the curved body piece so as to limit the forward motion of the ring. A flanged clamping ring, internally threaded, passes over the raised portion of the ear cap, the flange engaging the flange of the ear cap and the threaded portion engaging the threads of the body ring. Neither ring is secured save by engagement with the other.

Mr. F. O. Richey, of Elyria, Ohio, has adopted another method of securing the ear cap. The edge of the body piece is bent back on the outside so that there is a double thickness at this edge. Similarly the edge of the cap piece is bent inward. Both these folds are made to adhere to the foundation layer. This gives a double thickness of metal where the threads are required. Both these patents are assigned to the Dean Electric Company.

CENTRAL-OFFICE CIRCUIT SYSTEM.

At times difficulty is experienced from induction and leakage in keyboard forms, when ringing or other vibratory current is constantly applied to bus wires included in the keyboard form. To overcome such a difficulty, Mr. A. H. Weiss, of Chicago, has obtained a patent for a special method of wiring such forms. The keys are so arranged that the power wires may be straight straps passing at right angles across the key bank and tapping all keys. Relays are then arranged so that ringing power of any particular sort is applied to its corresponding bus wire only when demanded by the operation of one of the corresponding ringing keys. Mr. Weiss has assigned his patent to the Kellogg Switchboard & Supply Company.

Letter to the Editors

ELECTRIC SPOT WELDERS.

To the Editors of the Electrical World:

SIRS:—In the article on electric spot welders in your issue of Nov. 2 large economies are shown by use of these machines as compared with riveting with energy at 5 cents and 6 cents per kw-hr. As the duration of the weld with this type of welder is short the consumption cannot be accurately measured owing to the lag of the meter. Again, admitting that all energy consumed is measured, the return from this method of charging does not seem adequate to cover fixed charges on the large equipment necessary to supply energy for these machines. I should be glad to hear of a more equitable tariff for these welders.

London, Ont. H. J. GLAUBITZ.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Tripling the Frequency.—A. M. Taylor.—With reference to the paper of Spinelli abstracted in the *Digest* last week the author describes a modification of Spinelli's arrangement which he thinks is much cheaper and more efficient. In Spinelli's arrangement (Fig. 3 of the *Digest* last week) each of the three phases of supply acts on one of the outer limbs and saturates these limbs. The three inner limbs of the three transformers are surrounded by a common secondary winding. Unless, however, the fluxes reaching these central limbs contain third or other harmonics, the resultant flux will be zero and the emf in the secondary winding will also be zero. Moreover, if the emfs applied to the three outer windings contain no third or other harmonics, the fluxes will tend to be pure sine curves, the principal effect of running the saturation up so high being to cause the currents in these primary windings to contain a very sharp peak. The present author's arrangement is shown in Fig. 1. It is the certain and great rush

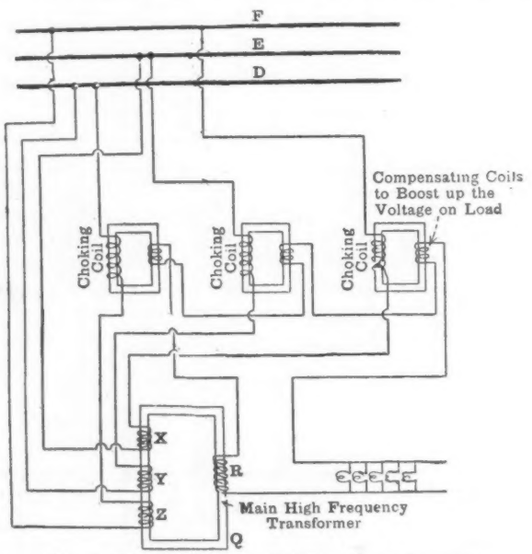


Fig. 1—Connections for Tripling the Frequency.

of current which he utilizes, taking it to a separate and unsaturated transformer, where every ampere of it is free to produce its proper effect upon the common secondary circuit. The author thinks there is an opening for such transformers on all systems of distribution which employ 25 cycles. If, for instance, such transformers could be used in kiosks in sparsely populated districts, to feed local low-tension mains for domestic lighting purposes, a great field would be opened in the way of "prospecting" a new district long before it would pay to put down a rotary converter substation. Then there are large numbers of factories which take energy for alternating-current motors where lighting would be welcomed but for the slight difficulty about the frequency. Then, there is the great advantage that the transformer also changes the voltage.—London *Electrician*, Nov. 1, 1912.

Balancers.—A. C. Lanier.—A mathematical article illustrated by diagrams on direct-current balancer sets. After discussing the operation of a two-wire generator with auxiliary balancing apparatus, the author discusses in some detail shunt-wound balancers and compound-wound balancers, the efficiency of balancer sets, commutation, stability and compounding, starting and parallel operation, and protection.—*Elec. Journal*, November, 1912.

Commutation.—Karl Pichelmayer.—The conclusion of his highly mathematical article on the theory of commutation. The article refers especially to several constants in the formulas for calculating commutation voltage.—*Elek. Zeit.*, Oct. 31, 1912.

Lamps and Lighting.

Gas Versus Electricity in Street Lighting.—An article on street lighting at Manchester by gas or electricity, based on the reports of Haydn T. Harrison and Jacques Abady upon the flame-arc lighting in Portland Street and the high-pressure gas lighting in Princess Street. The two authors did not agree on every point, and some of the tests were made along somewhat different lines, but they agree on the following conclusions: That for all practical purposes the degree of illumination in Portland Street and Princess Street is approximately equal. That, based upon the figure of costs of electricity and gas, etc., given by the respective departments, the arc lamps used in Portland Street are provided at an annual cost less than that of the gas lamps used in Princess Street. That, as a comparison between the possibilities of arc lighting and high-pressure gas lighting, the results are vitiated by the fact that the high-pressure gas lamps are giving an efficiency very much below similar lamps when properly installed and adjusted.—London *Electrician*, Nov. 1, 1912.

Photometry of Lights of Different Colors.—H. E. Ives.—The third paper in his serial on the photometry of lights of different colors. The author discusses the distortions in spectral luminosity curves produced by variations in the character of the comparison standard and of the surroundings of the photometric field. His chief results are as follows: With the equality-of-brightness method the effect of changing the color of the comparison field and of substituting light for dark surroundings for the photometric field is to introduce irregular and unsystematic shifts and distortions of the spectral luminosity curves. With the flicker method, the corresponding changes produce no alterations in the luminosity curves. The equality-of-brightness spectral luminosity curve obtained by taking small steps of slight hue difference agrees, at high illuminations, for a small field, with the curve given by the flicker photometer. It is concluded that the flicker photometer gives, under the specified conditions, the true brightness.—*Philos. Magazine*, November, 1912.

Generation, Transmission and Distribution.

Oil Fuel.—C. E. Stromeyer.—In his report to the Manchester Steam Users' Association the author refers to the attention which has been paid to the use of oil as fuel during the recent coal strike in England. He thinks, however, that oil cannot come into general use because its price would rise rapidly. Two very important advantages of oil firing are the ease with which it can be regulated and the absence of ashes and clinker. On the other hand, however, oil must be burned in brick-lined combustion chambers, which suffer severely from the intense heat and have to be frequently repaired and renewed. The modern steam engine requires 1.6 lb. to 1.7 lb. of coal per brake-hp per hour during a week's work of fifty-five hours. The oil engine requires 0.5 lb. of oil in the same time. With present prices it would cost just about as much to use a Diesel oil engine as a steam engine, but in remote districts the Diesel engine would probably show to advantage.—London *Electrician*, Nov. 1, 1912.

Corrosion of Boilers.—C. E. Stromeyer.—In his recent report to the Manchester Steam Users' Association the author reviews important recent research work on the

corrosion of iron and steel, and especially of boilers, with particular reference to the researches of Heyn and Bauer. Two conclusions which are confirmed by practical experience are that most ammonia salts are powerful corroders of iron, which accounts for the serious corrosion sometimes encountered in boilers fed with water that is contaminated with waste liquors from gas works, and, second, that when carbonate of soda is added to brackish water (water containing common salt) then severe pitting occurs, although the average corrosion may not be extensive. The protective action of oxidizing acids requires confirmation, if this be possible, by tests on boilers, and the well-known beneficial influences of deoxidizing agents require further scientific investigation. Reference is made to the use of certain salts which have recently been proposed to counteract corrosive influences.—London *Electrician*, Nov. 1, 1912.

Traction.

Single-Phase Traction.—J. SIMEY.—A fully illustrated description of the Westinghouse locomotive for the single-phase traction experiments of the railway company du Midi in France.—*La Lumière Elec.*, Oct. 26, 1912.

Budapest.—J. FISCHER DE TOVAROS.—The conclusion of his illustrated article on the electrification of the suburban railways of Budapest. The present instalment deals with the line construction, telephone and lighting service, rolling stock and the electric equipment of the cars. All the motors are interpole machines wound for 1000 volts.—*La Lumière Elec.*, Oct. 26, 1912.

Installations, Systems and Appliances.

Transmission System in an Agricultural District.—H. BÜGGELN.—An account of the financial results obtained by the electric transmission system of the Herrenberg district in Würtemberg, Germany. This is one of the first transmission systems in an agricultural district on a partnership basis in Germany. At the end of 1911 there were connected sixty-six villages and five farms with a total of 74,830 inhabitants. There are 2474 partners, and their liability is $309,250 (that of each partner being $125). The energy has been bought in the past from two outside stations, but increased demand has made it necessary to buy one of these stations and enlarge it by the erection of a 1000-hp steam turbine. The energy bought from the stations in 1911 was 24.7 kw-hr. per inhabitant; the energy sold was 15.6 kw-hr. per inhabitant. Energy was sold in the past only to partners at 5 cents per kw-hr. during the day and at 10 cents per kw-hr. after dark. The energy was measured by double-rate meters. A dividend of 4.5 per cent was declared, the same as last year. Since the cost of the energy is expected to increase, it is necessary to increase the consumption. This will be done in two ways. First, energy will be sold also to non-partners who will have to pay a rate 10 per cent higher than the partners. Second, a flat rate will be introduced tentatively for agricultural motors, as this has given good results in other distribution systems in agricultural districts.—*Elek. Zeit.*, Oct. 24, 1912.

Rate Making.—K. MARKAU.—An article on what is called in Germany the "Potsdam tariff," as it was first introduced in Germany in the city of Potsdam and shortly afterward in the city of Hanover. The fundamental idea is that a certain fixed readiness-to-serve charge is made per month according to the size of the residence and besides this a rather small rate is charged per kilowatt-hour consumed. The essential point is that this latter charge for the kilowatt hours is the same whether the energy is used for lighting, heating, motor or other purposes. The author thinks that this rate has the very great advantage that it permits all possible kinds of variations so as to suit every locality. For instance, in Hanover different readiness-to-serve charges are made for the summer and winter months, while in Potsdam the same readiness-to-serve charge is made for the whole year. As to the additional charge made per kilowatt-hour, this is based in Potsdam on the number of rooms and in Hanover on the electrical connections. The additional charge per kilowatt-hour is 2.5 cents in Potsdam and 5 cents in Hanover; but the principal character of the tariff is the same in both cities. This tariff can also be modified so as to make use of a double tariff for different hours of the day, etc. The paper is commented on by E. Wikander, who thinks that the flat rate is the best tariff for very small residences but recognizes the advantages of the Potsdam tariff, which is a combined flat and meter tariff, for larger residences. He thinks that the system used in Potsdam, where about three-quarters of the bill is paid as flat rate and one-quarter as additional charge according to the meter, is more effective than the tariff in Hanover, where about one-half is flat rate and one-half is paid per meter. A great advantage of the Potsdam tariff is that the present meters can be used without any charge whatever.—*Elek. Zeit.*, Oct. 31, 1912.

Energy Rates.—CARL RICHTER.—A conclusion of his mathematical paper illustrated by diagrams on graphical methods of representing and investigating different methods for charging for electricity. In the present instalment the author presents various diagrams illustrating the different types of tariffs now in practical use.—*Elec. u. Masch.* (Vienna), Nov. 3, 1912.

London Central-Station Account.—An abstract of last year's financial reports of the St. Marylebone (London) electric supply station. The total output was 13,500,000 kw-hr. and the total connections 22,500 kw. The generating expense per kilowatt-hour sold was 0.90 cent, the distribution expense 0.26 cent, the management expense 0.32 cent. The total cost, excluding capital charges, was 2.02 cents and including capital charges 6.10 cents, while the total revenue per kilowatt-hour sold was 6.40 cents.—London *Electrician*, Nov. 1, 1912.

Gas Versus Electricity for Domestic Purposes.—G. DETTMAR.—The first part of a long article illustrated by diagrams giving in detail the results obtained by the author in his household with lighting, cooking, etc., by gas exclusively and afterward by electricity exclusively, the records extending in each case over several years. The results will be given when the article is finished.—*Elek. Zeit.*, Oct. 31, 1912.

Wires, Wiring and Conduits.

Impregnation of Wooden Poles.—E. F. PETRITSCH.—The first part of an illustrated article on recent progress in impregnating wooden poles. The author thinks that at present wooden poles which are not impregnated should not be used at all. After describing the old Bethell process for impregnating wooden poles completely with creosote oil he describes various processes which permit a considerable reduction of the amount of creosote oil required since only the outside layers of the poles need be impregnated. These are the Ruping process, employing high pressure, and the Rutgers processes, in which uniform distribution of the creosote oil within the wood is accomplished by treatment with hot steam or hot air. The great disadvantage of these processes is that they can be used only for pine wood and not for fir wood. For the latter and for other kinds of wood which can be impregnated only with great difficulty Hattenberger and Berdnich have devised a process in which only the lower part of the pole buried in the ground is impregnated thoroughly, the rest of the surface receiving a slight treatment. For this purpose the bottom part of the pole is perforated by means of little needles so as to permit the entrance of the creosote oil. The paper is to be concluded.—*Elek. u. Masch.* (Vienna), Nov. 3, 1912.

High-Tension Cable.—W. PFANNKUCH.—The conclusion of his illustrated paper on the 30,000-volt, three-phase cable used on the suburban transmission system of the

Berlin Electricity Works. The present instalment gives in detail the results of the tests of the cable. Diagrams are given for the no-load loss as a function of the voltage and of the frequency and also for the behavior of the cable in switching in and out. The author concludes that the expectations which the designers had in constructing this large cable system have been more than fulfilled. No difficulties have resulted which could not be overcome by present engineering methods. The final conclusion is that the installation of a very high voltage cable network is perfectly possible and safe.—*Elek. Zeit.*, Oct. 31, 1912.

Electrophysics and Magnetism.

Oscillating Spark.—S. R. Milner.—An account of an experimental determination of the current-potential curves of the oscillating spark. The method of obtaining the curves is to employ the simultaneous electric and magnetic deflections at right angles of a beam of cathode rays, the electric deflection being produced by the potential difference of the spark and the magnetic deflection by the spark current. The results are applied to a discussion of the mechanism of spark conduction. There are three characteristic potential differences which occur in the condensed spark, namely, the initial sparking potential difference of some thousands of volts, the glow potential difference (300 volts) between the oscillations, and the arc potential difference (35 volts), which lasts throughout the greater part of each oscillating discharge. The initial high sparking potential performs the function of ionizing the air in the gap and of causing the necessary rise of temperature of the cathode. The arc potential difference is partly accounted for by a drop at the cathode sufficient to keep up the temperature to the right value and partly by the field throughout the gap necessary to make the ions carry the current. The comparatively low temperature of the instantaneous anode in the spark forms a characteristic difference between it and the arc discharge. This low temperature explains the occurrence of the glow potential difference between the oscillations. If the temperature of the anode were the same as that of the cathode, there is no reason to suppose that on the reversal of the current the arc character of the discharge should not remain unchanged, for the air in the gap must still be strongly ionized. But on the reversal of the current at the first instant what is now the cathode is comparatively cool and it cannot supply the necessary corpuscles at a sufficient rate. Since the air in the gap is already ionized, we have now the exact conditions necessary for the glow of discharge. The author finally considers the following features of the spark: the core and sheath, spectra of core and sheath, and the nature of the streamers.—*Philos. Magazine*, November, 1912.

Dust Figures Produced by Electrical Sparks.—E. H. Barton and W. B. Kilby.—An account of an experimental investigation which shows that dust figures may be obtained corresponding in their chief features to the ordinary optical phenomena of reflection, refraction, interference and diffraction, but that, in addition, the air currents sometimes acquire circulatory or vortex motions and thus introduce into the dust figures features not present in the optical cases to which they were expected to be analogous.—*Philos. Magazine*, November, 1912.

Bending of Electric Waves.—J. W. Nicholson.—The fifth paper of his highly mathematical series on the bending of electric waves around a large sphere. In the present instalment the author investigates the points near the axis in the region of brightness and gives a general investigation of the shadow.—*Philos. Magazine*, November, 1912.

Electrochemistry and Batteries.

Ozone.—W. H. Thompson.—An illustrated article describing the characteristic properties of ozone and various types of apparatus for the production of ozone by silent discharges. After noting two methods for measuring the amount of ozone in air the author deals with the physiological action of ozone in the treatment of various diseases and with commercial uses of ozone for the sterilization of air and water, etc.—*Elec. Journal*, November, 1912.

Units, Measurements and Instruments.

Rectangular Galvanometer.—A. Ferguson.—In all absolute instruments the cylindrical type is chosen on account of the relative ease with which a cylindrical surface may be turned. But if the use of metallic materials is vetoed on account of the possible presence of traces of magnetic substance, the construction of a wooden bobbin which shall reduce the danger of warping to a minimum is a matter of some difficulty. On the other hand, it is fairly easy to construct a strong wooden rectangle so that the irregularities in its surface shall be small compared with the unavoidable experimental errors introduced in reading the deflections of the magnetometer, etc. The author describes a rectangular coil galvanometer and gives a complete theory and data as to constants. His instrument shows roughly the same order of accuracy as the standard cylindrical coil. It is simple in construction and use and reliable in results, while it possesses two main outstanding advantages: For a given length of winding it is more sensitive than the circular form, and any departure from trueness in form can be readily and exactly allowed for.—*Philos. Magazine*, November, 1912.

Connections for Interrupter.—Electromagnetic interrupters of the ordinary kind can be built only for a tension of a few volts. In order to operate them from a network at from 110 volts to 440 volts the connections shown in Fig. 2

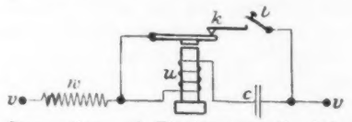


Fig. 2—Connections of Electromagnetic Interrupter.

may be used, in which u is the interrupter, w a high series resistance and c a condenser of about 1 mfd capacity. The contact k is first closed, while the switch t is open so that the condenser c is charged from the supply voltage vv. When the switch t is closed the condenser discharges through the magnet coil in form of a damped oscillation. The armature is attracted and the contact k is opened so that the condenser is charged again, and so on. The contact k interrupts only the small non-inductive current which passes through the series resistance, while the condenser helps to suppress the formation of sparks. For the opera-

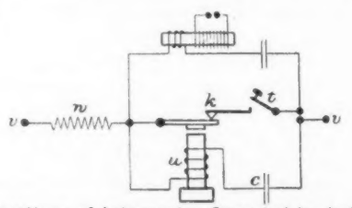


Fig. 3—Connections of Interrupter Operated by Induction Coil.

tion of induction coils the arrangement shown in Fig. 3 may be used, the induction coil, together with a special condenser, being connected in parallel with the interrupter.—*Elek. Zeit.*, Oct. 24, 1912.

Photometric Pressure Recorders.—A note on a recent British patent (No. 23,931, Oct. 24, 1912) of S. J. Dow. A photometric screen is placed in a box of suitable construction impervious to light, with an observation window. On one side of the screen is a carbon-filament lamp and on the other a metallic-filament lamp of about equal power, in parallel with the first. Adjustment is made so that the two sides of the screen are equally illuminated. Any variation of pressure affects the lamps unevenly, so that the screen is not equally bright.—London *Elec. Enging*, Oct. 31, 1912.

Frequency Indicator.—A note on a recent British patent (No. 628, Oct. 24, 1912, British Thomson-Houston Company, Ltd., and the General Electric Company of this country). A frequency indicator which is highly sensitive over a small range is obtained by providing one of the two relatively movable elements with two windings which exert opposing forces on the other element, and the circuit of each winding is tuned for a different frequency, above and below the average frequency to be indicated, by means of an adjustable resistance and condenser, connected in series with each of the coils.—London *Elec. Eng'ing*, Oct. 31, 1912.

Measuring Instruments for Central Stations.—R. O. HEINRICH.—A paper read before the Dresden Electrical Society on direct-reading instruments for central stations. After some general remarks on the best length of scale and length of the needle and the general construction of indicating switchboard instruments the author, who is the director of the German Weston Instrument Company, describes a great number of Weston instruments, distinguished as electrodynamic and electromagnetic instruments. Among the former he describes the Weston wattmeter, synchroscope and power-factor indicator, and among the latter the Weston frequency meter.—*Elek. Zeit.*, Oct. 24 and 31, 1912.

Meter.—An official communication by the Reichsanstalt admitting for calibration an Aron meter with double-counting mechanism for double rates.—*Elek. Zeit.*, Oct. 31, 1912.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—MOSLER.—An illustrated article on an investigation which extended over the course of a year on atmospheric disturbances in wireless telegraphy and the distribution of the maxima and minima during the summer and winter. The disturbances depend greatly on purely local conditions due to variations of the electric potential of the atmosphere. Disturbances due to lightning discharges do not exert any effect on receiving stations at a great distance. Near mountains the disturbances occur oftener than in flat country. Hail and snow increase the number of atmospheric disturbances.—*Elek Zeit.*, Oct. 31, 1912.

Wireless Telegraphy.—S. KIMURA.—A conclusion of his long mathematical article on the design of a radio-telegraph station. In the present instalment the author discusses the internal design and in an appendix he gives references to literature and various notes, chiefly of a mathematical character.—London *Electrician*, Nov. 1, 1912.

Miscellaneous.

The Ignition of Coal Gas and Methane by Momentary Electric Arcs.—W. M. THORNTON.—An illustrated paper read before the (British) Institution of Mining Engineers. The results obtained by the author may be arranged in three groups, the first dealing with the influence of direct-current break sparks on ignition; the second with the change in the least igniting current produced by altering the proportions of gas and air; the third with ignitions by alternating current and the influence of frequency. Direct currents are very approximately proportional to the reciprocal of the voltage. Methane is not so readily ignited as coal gas in mixtures of the same percentage, but in the most explosive mixtures the difference is small. The igniting currents are found to be rising linear functions of the diameter of the rods, the rate of change with diameter being the same in each case. The energy of the least spark to ignite gas is found to be about 0.1 joule. The time of duration of the spark at first increases, then decreases, and rises again with the voltage. The influence of varying the proportions of the gas and air is very marked. The igniting currents for coal gas and methane have in each case the same type of transition, which can be accounted for by regarding the result as the combined effect of the "time of explosion" and the dilution of the explosive mixture by excess of either constituent. There is a great difference between alternating and direct-igniting currents, the former having much higher values and a remarkable curve of variation with voltage. This is shown to depend upon the frequency, period of induction, and voltage, ignition being much more difficult at the higher frequencies used. It follows that the use of low-voltage alternating currents for signaling purposes gives a much greater margin of safety than is possible in direct-current working.—London *Electrician*, Oct. 18, 1912.

Scientific Shop Management.—G. C. ALLINGHAM.—A paper read before the Junior Institution of Engineers in London. The author describes the system of motion study introduced by F. W. Taylor, whereby the minimum amount of labor required for any piece of work can be ascertained. By systematic study of the various movements performed in carrying out any work the output of the work may be tripled, or even quadrupled, while the physical effort expended may be reduced. The author says that the United States is rapidly adopting the new system and it is important that Great Britain should do the same if it is not to be left behind.—London *Electrician*, Nov. 1, 1912.

Book Reviews

COMMERCIAL ENGINEERING FOR CENTRAL STATIONS. By Arthur Williams and Edmund F. Tweedy. New York: McGraw-Hill Book Company. 142 pages, 27 illus. Price, $2.50 net.

A useful manual for central-station sales engineers presenting data which will be of assistance in estimating the cost of central-station service in office and loft buildings, department stores, refrigeration plants and similar establishments. Two excellent chapters are included on the cost of generating electrical energy in central stations of small and medium size, giving the actual results obtained in a large number of plants. Other chapters have been added on ozone and sewage purification. While the subject matter of the book is not entirely consecutive or continuous and no index has been supplied by the authors, the data presented are valuable, and commercial engineers in the central-station field will find it exceedingly helpful.

DER TORSIONSINDIKATOR. By. Dr.-Ing. Paul Nettmann. Berlin: M. Krayn. 78 pages, 34 illus. Price, 4 marks.

A pamphlet devoted to electrical methods of measuring the twist of a shaft when in operative rotation. The problem of determining the amount of torsional displacement or twist in a rotating propeller shaft is of considerable interest to marine engineers. A number of electrical methods have been either used, attempted or proposed for determining such twists. These are explained in considerable detail. The pamphlet will be of interest to marine engineers and to mechanical engineers dealing with shaft drives.

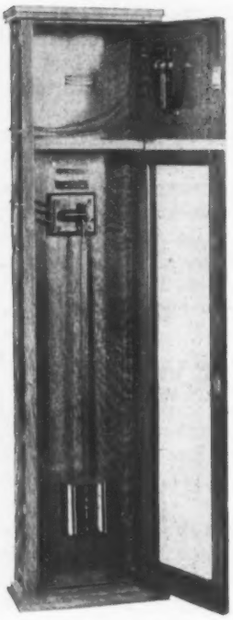
LA THÉORIE DES IONS ET L'ÉLECTROLYSE. By A. Hollard. Paris: Gauthier-Villars. 220 pages, 16 illus. Price, 5 francs.

A treatise on the electronic theory of electrolysis and of electrolytic solutions from the chemical standpoint. It constitutes a textbook on the elementary theory of ions from the analytical chemist's point of view. It is, therefore, a useful supplement to the physical theory of the same subject. The work is divided into four sections, each containing two or more chapters. Section 1 discusses the constitution of electrolytes, Section 2 the conductivity of electrolytes, Section 3 the voltage necessary for electrolysis, and Section 4 electrical energy in electrolysis. The book will commend itself to students of chemistry specializing in electrochemistry. It is well up to date.

New Apparatus and Appliances

ELECTRIC TIMING MECHANISM.

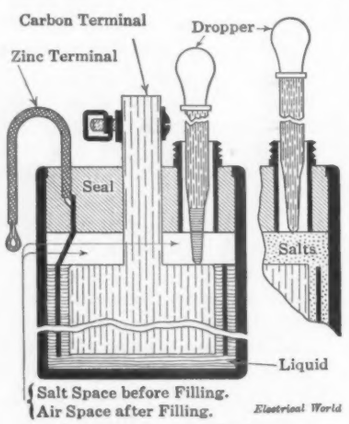
The Electric Time & Manufacturing Company, of West Lafayette, Ind., has recently placed on the market the Moore electric clock, one form of which is illustrated herewith. The time-measuring device consists of a simple pendulum actuated by an electromagnet, the arrangement being such that the forces acting are independent of battery strength. The registering device, of which there may be one or many, is also electromagnetic in character and so designed that the energy consumption is a minimum. This simplicity of arrangement, apparent from the illustration, insures long life and reliable operation. Obviously, since the registering mechanism is quite independent of the time-measuring apparatus, the register may be used to open and close an external electric circuit at any time or at any desired time interval. One of the features of the clock is its low energy consumption, the current required for the pendulum being but 2 milliamperes and that for the registering devices 4 milliamperes each. The electrical pressure used is that of a single dry cell, or about 1.25 volts. Accuracy is easily obtained in this timing mechanism, the rate being adjusted in the usual manner by changing the length of the pendulum. One of these clocks, by a service test of almost two years, it is claimed, has proved the reliability, durability and accuracy of the mechanism.



Electric Clock.

SEALED PRIMARY BATTERY.

The Burn-Boston Battery & Manufacturing Company, Boston, Mass., has recently brought out a form of dry cell known to the trade as the "Noloss" battery. The general design resembles that of the company's standard carbon, zinc and sal-ammoniac cell. It is waterproof and moistureproof and is built in two sizes having capacities of 30 amp-hr. and 50 amp-hr. The manufacturer contends that this cell will last from five to seven times as long as ordinary dry cells at a little more than double the first cost of the latter, and that this proportion is increased in case the dry cells depreciate while standing. This cell is recommended by the maker for service where batteries alone are depended upon for ignition, without storage cells or a magneto, on two-cylinder and four-cylinder automobile engines, with ordinary vibrating coils. On motorboats it is usual to ignite one-cylinder 2-cycle and two-cylinder 4-cycle engines for one season without attention, when used for pleasure purposes, on six cells of this type under fairly dry conditions. The battery is designed with a zinc connection composed of a flexible wire permanently soldered under the sealed top, and the carbon terminal is provided with a lock-nut washer. As shown in the accompanying cross-section, the cell is compact and can be easily filled by a medicine dropper.



Cross-Section of Battery.

This type is also specially designed for use in connection with bells, telephones, electric clocks, automobile tail and side lights, railway signaling, electric gas lighting, medical coils, miniature motors, fire-alarm systems and similar electrically operated appliances.

METER-SEAL WITH RENEWABLE PARTS.

Many central-station companies are looking for a better method of securing their meters against tampering than the old-fashioned lead seal. With a little patience almost any ordinary lead seal can be "worked" so as to remove and replace the seal wires without giving evidence of tampering. A new strap seal developed by the Security Seal Company, 23 Stevenson Building, Pittsburgh, Pa., and illustrated herewith, affords greater protection to the meter, and, after being equipped, such meter-seal renewals will cost less than lead seals. The device consists of three units—a pair of straps which take the place of the sealing wire on the front of the meter, a locking unit and a renewable plunger. Where straps cannot be used a cap is furnished for sealing with wire. All parts with the exception of the plunger are permanent and will last as long as the meter. The plungers as now furnished are made of white metal and bear the company's and installer's initials. As a die-cast process is used, these plungers cannot be duplicated without special equipment and at prohibitive expense. If desired, gutta-percha, glass or aluminum plungers can be furnished. Porcelain plungers can be marked and dated by the man making the setting. The locking unit is a small double washer with internal spring teeth which grip the plunger. To open the seal the plunger head must be severed from the shank, after which it can be pushed on through, but it cannot be withdrawn without giving evidence of tampering.

Fig. 1—Meter Provided with Metal Seal.

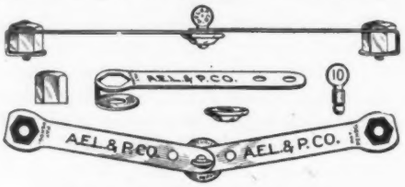
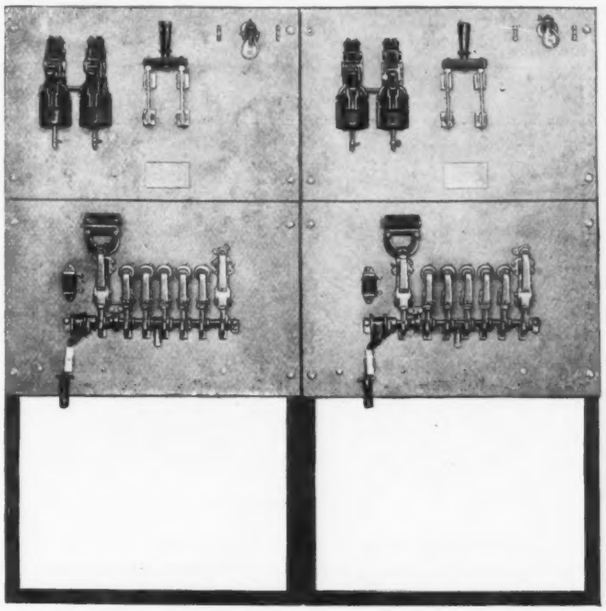


Fig. 2—Details of Meter Seal.

MANUALLY OPERATED FIRE-PUMP STARTERS.

The accompanying illustration shows a duplex panel for manually starting two 125-hp, 220-volt fire-pump motors. When installed the entire panel is inclosed in a splash-proof ventilated case with doors and a removable back. The bottom of the panel must be at least 2 ft. above the floor. No fuses are placed in the operating circuits, although automatic release and overload release are provided. No fiber parts are used, there are no iron-to-iron bearings, and all iron or steel parts are copper-plated or enameled. Starting is accomplished through a single lever with "butt" accelerating contacts, seven on these panels. A pilot lamp is placed where the meter indicating the voltage of the line supply will be located. The resistance is mounted on the backs of the panels and is inclosed. This panel was made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.



Starting Panel for Fire-Pump Motor.

ELECTRIC-HEATED BLANKET FOR FRESH-AIR SLEEPERS.

Several novel features distinguish the new electrically heated blanket recently placed on the market by the National Electric Company, 506 South Fifth Avenue, Chicago. This blanket is intended for continuous operation and consumes but 50 watts, simply replacing electrically the heat normally radiated by the human body. It thus takes the place of an exhaustive thickness of heavy bed clothing, maintaining the body warm and comfortable throughout the night, without possibility of overheating. A fine, enameled wire is used as the resistor element, and this conductor is carefully sewn into the cloth of the blanket. As the wire is insulated, possibility of shock is removed even should the covering become moist. The toughness of the improved resistor material employed prevents kinking or breaking of the wire. The fabric used is of the best quality and will outwear any ordinary comforter. A covering of the best sateen is furnished, red, old-rose or delft blue in color, as desired, and the whole electric blanket is soft and flexible and can be folded into a neat, compact form when not in use. Two sizes are available, 36 in. by 72 in. and 54 in. by 72 in.

This blanket is especially intended for persons sleeping outdoors or with windows open to the winter air, a health measure which has recently become deservedly popular. Without excessive covering a comfortable warmth is imparted to the sleeper, and as the energy consumption is low, 50 watts, there is no possibility of the device overheating. The bed may be warmed in advance by turning the current on the blanket thirty minutes before the occupant retires. When in use the electric blanket should be covered with another light blanket to "hold in" the heat generated.

Bed with Electrically Heated Blanket.

THE ELECTRICAL EQUIPMENT OF A BREWERY.

By V. V. Newell.

The plant of the Acme Brewing Company at Macon, Ga., has during the past year been equipped throughout with induction motors for driving its machinery, and some interesting problems were encountered during the work of making the changes. The brewery was enlarged several years ago and the old plant remodeled, bringing it up to date and making it a model in every respect for the purpose it was designed to serve. Its producing capacity was more than doubled, a 350-barrel kettle being provided, with all other equipment in proportion.

The generating equipment which was installed at that time, with the exception of the ammonia compressors, consisted of two 75-kw, 220-volt direct-current generators driven by reciprocating engines, the one belted and the other directly connected. A major part of the machinery was equipped with individual motors. This installation was quite satisfactory in so far as its reliability was concerned, but proved rather expensive in the amount of energy consumed. When, therefore, the Central Georgia Power Company proposed to furnish energy at a rate which seemed very satisfactory in comparison with the cost of the isolated plant, the proposal was accepted. Three-phase alternating current was to be transmitted at 6600 volts and 60 cycles to the brewery, the emf being there stepped down to 550 volts.

In order to make use of the old direct-current motor equipment, which was giving good service, one 75-kw direct-current generator was directly connected to a 100-hp induction motor and this motor-generator set furnished direct current for motor service and lighting. However, after a comparatively short time of service the expense was found to be much larger than was expected, while the cost of coal, oil, etc., was not decreased correspondingly. Upon investigation it was found that most of the motors were from one-third to two-thirds larger than was required to handle the maximum loads placed upon them, and also that the motor-generator set during most of the day was loaded to only about one-third of its rating. At night, when the entire load comprised only a few pumps and the necessary lamps, the load was from one-fourth to one-sixth of the normal rating of the generator. From the results of actual operating tests it was estimated that a reduction of one-third in the energy consumption could be made by eliminating the motor-generator set and installing induction motors of proper rating in place of the direct-current

individual motors. A further saving could be assured owing to the decrease in expense for repairs and attention because of the simplicity of the induction motor.

It was decided to use 550 volts for motor service and 110 volts for lighting throughout the plant. Some doubt at first was entertained as to the advisability of using 550 volts in the cellar on account of the excessive moisture with the accompanying danger of insulation troubles. Up to the present time, however, not the least trouble has been experienced in this respect, and this is partly explained by the care that was taken in wiring the place. This wiring had formerly been run in conduit, but it was found that trouble was experienced from moisture getting into the junction boxes. The wiring for both lighting and motors was, therefore, changed to lead-covered open wiring in the cellar and other damp places, and the remainder of the circuits were carried in conduit.

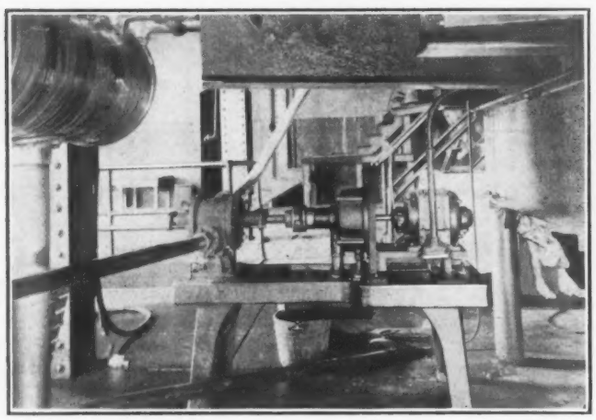


Fig. 1—2-hp Motor Connected Through Gear Box to Mash Pump.

Among the problems which presented themselves was that of a 4000-lb. freight elevator. This elevator had always worked very smoothly with the 220-volt direct-current motor and gave little trouble. In order to operate this equipment from the alternating-current circuits a 15-hp induction motor was provided with wound rotor and a set of external resistances for purpose of acceleration. The old magnet for the brake was replaced by a solenoid suitably attached to the brake lever to provide electric control similar to that obtained with the magnet. This outfit provides a very satisfactory substitute for the original drive, the former mechanical features being retained.

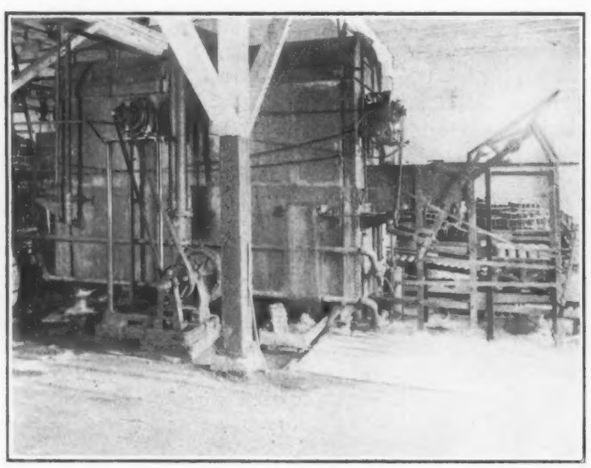


Fig. 2—7.5-hp Motor Operating Automatic Bottle-Washing Machine.

The four beer pumps, all of which were of the slow-speed rotary type, each with an individual motor connected to it through a speed-reducing mechanism, were also readily changed over to alternating-current drive. It was decided to use one motor in each cellar, driving the pumps by shafting and belts. The direct-current motor on each pump was therefore replaced by a suitable pulley and bearings, and the two pairs of pumps are driven by two 5-hp motors through moisture-proof belts. These twin drives provide ample flexibility and at the same time reduce the total power required.

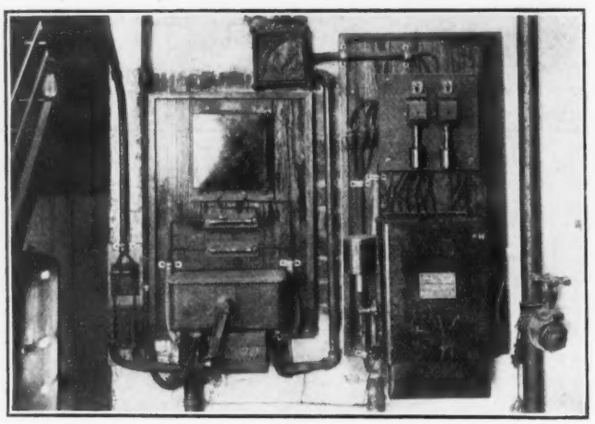


Fig. 3—Automatic Oil Switch and Starting Compensator.

Another instance that illustrates the value of an accurate knowledge of the power required for the various machines is seen in the grinding room. The rolls for grinding malt were formerly driven by a 20-hp direct-current motor, but it was found upon careful tests that a 7.5-hp motor was sufficient for the work. An induction motor of this rating was therefore provided, geared directly to the rolls of the grinder. This outfit is designed to clean and grind 100 bushels of malt per hour.

In the bottling works it was also found that the power required was much less than the normal rating of the 15-hp direct-current motor which was belted to the main shaft. The power actually consumed did not exceed 7.5 hp, and an induction motor of this rating was consequently installed.

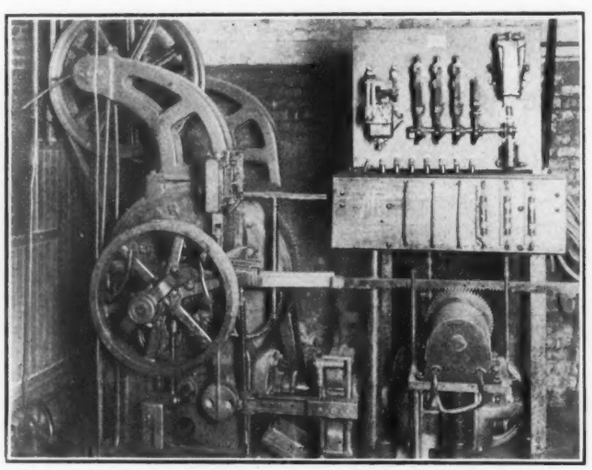


Fig. 4—15-hp Motor Directly Connected to 2-Ton Electric Elevator.

An air compressor in the brewery had been purchased at the time when air was used for hoisting ice as well as for other purposes in the brewery and bottling house. Later on when the old air hoist had been discarded and replaced by an electric hoist the compressor was much larger than was required for use in the brewery and bottling house alone. In order to maintain the desired air pressure in the

receiver a 15-hp motor was provided with an automatic pressure regulator designed to maintain air pressure between 40 lb. and 50 lb. per square inch. As soon as the pressure reaches the predetermined maximum the compressor motor is automatically cut out until the pressure again falls to the lower limit.

The new installations comprise a total of twenty-six motors with an aggregate rating of 199 hp. Of these motors eight were connected to groups of machines through belt drive and eighteen were connected for individual drive, seven of these being directly connected, four being geared and seven being belt-connected to their respective machines. All of the motors were furnished by the General Electric Company.

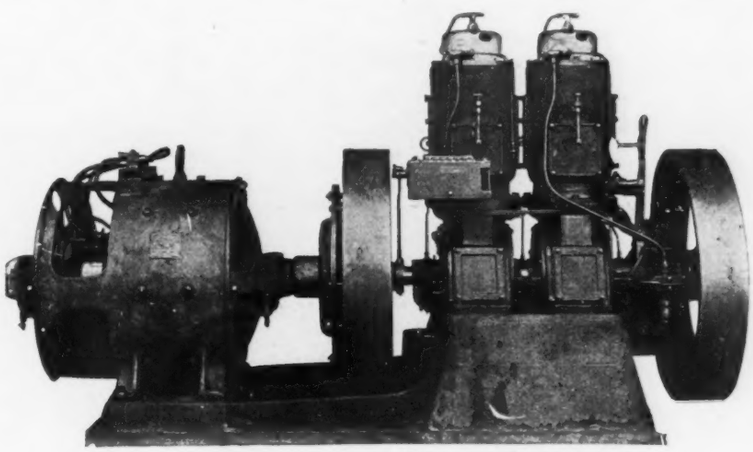
With these new arrangements the cost of motive power has been reduced by about 50 per cent and the energy consumption about 60 per cent. The "ready-to-serve" clause in the contract with the central-station company makes up the difference between percentage saved in money and that saved in energy.

OIL-ENGINE-GENERATOR SET.

The oil engine is an extremely simple and efficient prime mover for electric generating units and is particularly well suited for small central stations and isolated plants. The set illustrated herewith, consisting of a 30-hp oil engine and a 15-kw generator, is manufactured by the Remington Oil Engine Company, 120 Broad Street, New York, N. Y. It utilizes kerosene, gas oil, distillate or any other low-grade fuel. The engine and generator are mounted on a common base and connected with a flexible coupling. The set occupies a floor area of 3 ft. x 8 ft. 4 in., is 5 ft. 4 in. high and weighs 6700 lb. It is claimed that the fuel consumption is less than 1 pint per brake-hp-hour. The engines are made in sizes from 6 brake-hp to 60 brake-hp with one, two and four cylinders. The generators are rated at from 3.5 kw to 40 kw.

The ignition in these engines is accomplished by compressing the air in the combustion chamber until the temperature has risen to a point high enough to vaporize the fuel, when it is injected. A centrifugal governor on the flywheel controls the length of stroke of the fuel pump, increasing or diminishing the quantity of fuel injected into the combustion chamber as the load on the engine is increased or decreased.

These engines are said to be equally economical and reliable when used for pumping, hoisting, operation of refrigerators, air compressors and in other industrial services. Other engines built on the same principles are specially designed for marine service.



30-hp Oil-Engine Electric Generating Set.

VEHICLE CALL SYSTEM.

Edwards & Company, Inc., of 140th and Exterior Streets, New York, have recently put upon the market an electric system for calling vehicles. This plan has embodied in it several ideas which are advanced to overcome the annoying and disagreeable features of the methods now commonly used for summoning the drivers of public and private conveyances. The criticism made of the old method is that it is less orderly, convenient, dignified and efficient than the new system.

Fig. 1—Installation of Vehicle Call System.

The necessary apparatus for operating this vehicle call system include a 1/16-hp motor geared to a shaft which causes to revolve the three number-bearing cylinders illustrated in Fig. 1 and a switchboard control for starting the motor from the vestibule of the building on which it is placed, as shown in Fig. 2. In addition to these there are, of course, the necessary wiring and lighting appliances. The annunciator is manufactured in three types with two, three and four revolving cylinders, which give 25, 125 and 625 calls respectively.

Fig. 2—Control Board for Vehicle Call System.

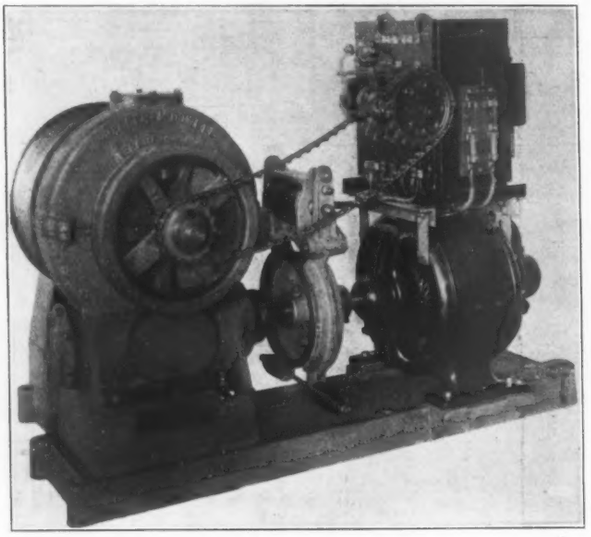
As an illustration of the way in which the new plan operates, a specific instance may be given as follows: An automobile draws up to the curb and stops. An attendant is at hand to open the door and assist the passengers to alight, at the same time presenting to them a card bearing

a number, a duplicate of which is given to the chauffeur, who then drives away to await the appearance on the annunciator of the number which he holds. When the passengers return to the door and present their number card to the attendant that number is immediately displayed on the annunciator and a bell or whistle is sounded to attract the attention of the drivers. The operation of the bell or whistle is the only noise which is occasioned in summoning vehicles by this method, the repeated shouting necessary under the old method being done away with.

It is claimed that no special skill or training is required on the part of the attendant, as his only duty consists of setting the hands of the dial at the proper figures. The new device automatically "does the rest."

ELEVATOR MOTOR.

The accompanying illustration shows one of a complete line of Watson direct-current motors for elevator service. Although the standard line of Watson direct-current motors is made in sizes up to and including 15 hp, the elevator line



Elevator Motor.

which has been under development for some time includes sizes up to 20 hp. Smooth, quiet-running, good commutation and good torque at starting are the principal points of advantage claimed.

In this motor, as in other Watson motors, the bearings, shaft and other mechanical features are ruggedly and compactly built. This line is especially adapted for moderate-speed passenger and freight service. The maker of the elevator motor is the Mechanical Appliance Company, Milwaukee, Wis.

HIGH-POTENTIAL FUSES UNDER SERVICE CONDITIONS.

In a paper on "High-Tension Distribution in Northern Illinois" read at the recent Peoria convention of the Illinois State Electric Association and written by Mr. H. B. Gear, engineeer of distribution of the Commonwealth Edison Company of Chicago, an interesting reference was made to the use of new high-potential fuses. Mr. Gear said, speaking of the jointly operated systems of the Public Service Company of Northern Illinois and the Illinois Northern Utilities Company:

"The protection of 33,000-volt transformers and fuses is a problem which is as yet not wholly solved. A few installations of 25 kw to 50 kw have been made, which are protected by the S. & C. type of fuses. This consists of a fuse supported in a glass tube under the tension of spiral springs, the tubes being filled with carbon-tetrachloride and securely sealed. Such an installation is shown in Fig. 2,

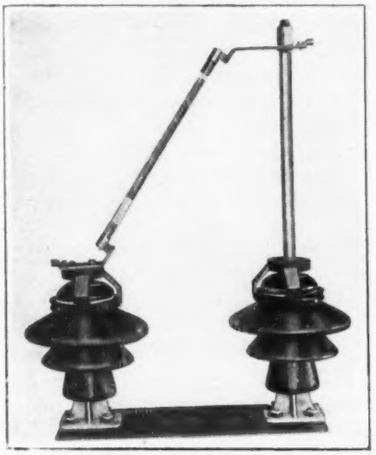


Fig. 1—Mounting of New-Type High-Potential Fuse.

the transformer being 25 kw in this case. The experience which has been had with this fuse thus far seems to indicate that it will be satisfactory for outdoor use up to 150-kw units. Larger sizes of transformers are usually in a substation, where circuit-breakers provide necessary protection."

The S. & C. high-tension fuses referred to are made by Schweitzer & Conrad, of Chicago, with mountings designed

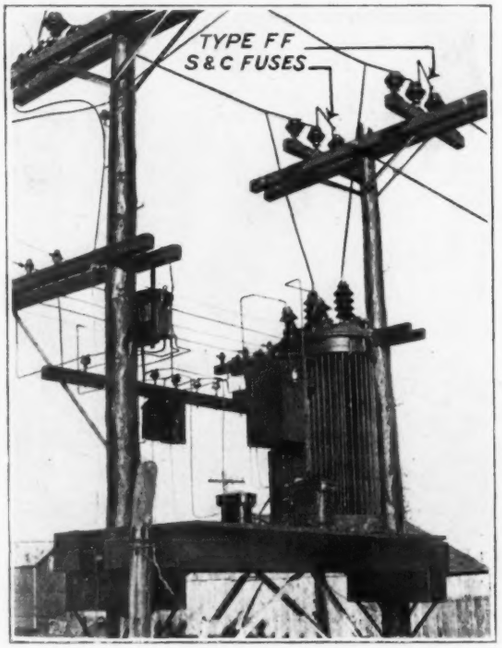


Fig. 2—New-Type High-Potential Fuse for 33,000-Volt Outdoor Transformer.

by the Delta Star Electric Company of Chicago. They are designed both for station use and for the protection of outdoor electric construction. Fig. 1 shows the fuse and method of mounting, the type illustrated being the same as shown installed in Fig. 2. In this fuse the glass tube is filled with a non-inflammable liquid described as having extremely high dielectric strength, with none of the objec-

tionable characteristics of oil. The liquid extinguishes the arc and interrupts the current flow, this action being still further accelerated by the contraction of the spiral spring simultaneously with the melting of the fuse wire, thus introducing a very large gap. The dielectric strength of the liquid is spoken of as being about 250,000 volts per inch, and therefore the gap between the top ferrule and the top end of the submerged spring gives a factor of safety equivalent to several hundred thousand volts. Numerous tests have been made, submitting the fuse to severe conditions of short-circuit, and the results obtained have been so marked as to excite the favorable comment of both foreign and American engineers.

Another interesting statement made in relation to this fuse has to do with the heavy current handled during the moment of short-circuit without any destructive results to the fuse. Eighteen-ampere (continuous rating) fuses are said to have operated successfully with instantaneous maxima of 1220 amp and 1250 amp. The 1-amp or shunt-transformer fuses operated successfully with instantaneous maximum-current values ranging from 160 amp to 1170 amp, the instantaneous-current values depending obviously upon the point of the emf wave at which the short-circuit was made.

TIME RECORDER.

The Industrial Instrument Company, Foxboro, Mass., has just added to its line of recording instruments a mechanical time recorder, illustrated in Fig. 1. The instrument is mounted in a round case of the same size and design as those used with other recorders. The pen arm is attached to and supported by the shaft or axle. An arm attached to the shaft passes through the case and an extension with adjustable clamps serves to facilitate the adjustment of the pen on the chart. Clock movements are supplied to revolve the charts in fifteen or thirty minutes, one, two, three, four, six, twelve and twenty-four hours and seven days as desired. The purpose of the mechanical time recorder is the recording of frequency, duration and extent of any mechanical motion, such as opening and closing of gates, valves, doors or similar operations.

Fig. 2 illustrates an electrical time recorder just placed on the market by the same company. This instrument, instead of being operated by mechanical motion, is operated by electric contact and consequently is adapted for use in places where the recorder itself is to be located at a distance from the source of motion or operation. When contact is made the current actuates an armature to which the pen arm is attached and the chart records the frequency and duration of contact. The illustration shows four pens for recording four independent operations simultaneously on the same chart. These recorders are built with any number of pens up to six.

SMALL ELECTRIC DELIVERY WAGON.

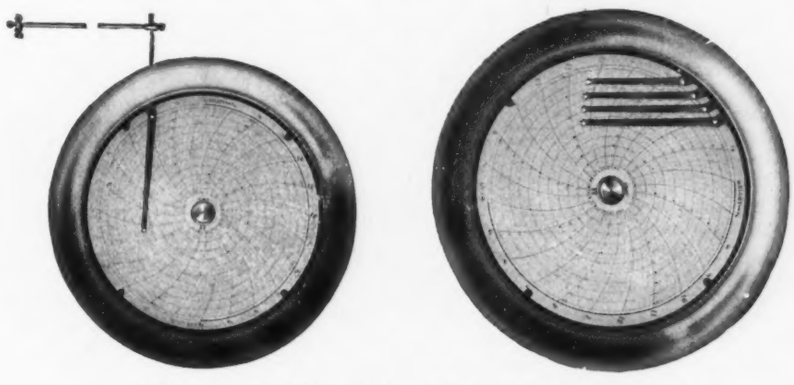
The Baker Motor Vehicle Company has added a delivery runabout of 500-lb. carrying capacity to its line of electric commercial vehicles. This car, which is fitted with bevel gear, shaft drive and pneumatic tires, has a speed of 20 miles per hour and will travel from 60 to 100 miles on a single charge.

Small Electric Delivery Wagon.

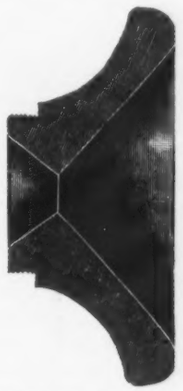
The body is made open or inclosed, the former having a loading space of 30 in. by 30 in., while the panel body, which is fitted with rear doors, has a loading space 32 in. long and 36 in. wide, measured at the seat level. The motor is of the same design and construction as those used in large trucks manufactured by this company.

TELEPHONE MOUTHPIECE.

A telephone mouthpiece of distinctive design has recently been placed on the market by the Electrose Manufacturing Company, of Brooklyn, N. Y. The particular improvements claimed for this style of attachment over the type now in use are that it is more sanitary and more substantial. The bell of the mouthpiece is made shallower and more flaring than the mouthpiece now in general use, so that it lends itself more readily to the application of the dust cloth. The shell is made thicker than on the older design, and this, combined with the reduced depth of the shell, makes it able to withstand rough usage. Instead of containing several perforations for admitting the sound waves, one large circular aperture is used, which is nearly large enough to admit an ordinary lead pencil. These mouthpieces are manufactured to fit the face plate of any standard transmitter. It is claimed that the volume and quality of transmission are as good as with any other type.



Figs. 1 and 2—Mechanical and Electrical Time Recorders.



Telephone Mouthpiece.

Industrial and Financial News

REPORTS from all sections of the country show that the trade activity of recent weeks is not only sustained but is expanding rapidly. Buying for future requirements on much broader lines than in the past few months is one of the most distinctive tendencies of the present situation. Another very noticeable change in trade conditions is that many remote parts of the country are now beginning to respond to the activity at the large trade centers. Bank clearings were 13 per cent larger last week than in the week preceding, and were 9 per cent greater than in the corresponding week of 1911. Prompt delivery is being sought for all classes of material. All branches of the electrical industry show that progress is being made. Items elsewhere in these columns show substantial increase in the volume of sales made by the General Electric and Western Electric companies. Representatives of the Allis-Chalmers Company state that business is improving with that concern and that contracts aggregating 68,500 kw were closed by it in October. Many of the electric-vehicle manufacturers report gains over last year's business. In addition to the electrification plan of the Denver & Rio Grande Railroad Company, referred to elsewhere in this issue, it is understood that details of another project of similar nature will be available for publication within a few weeks.

J. G. White & Company, Inc., Form Two Subsidiaries.—Announcement was made this week by J. G. White & Company, Inc., 43 Exchange Place, New York City, of a plan for segregating their engineering and operating departments through the formation of two new corporations, one to be known as The J. G. White Engineering Corporation and the other to be known as The J. G. White Management Corporation. The former will take over the engineering-construction department of the present company, and the latter will take over the present operating or managing department. J. G. White, president of the company, says in his announcement of the plan that for some years past it has been the opinion of a number of the officers and directors of the company that the latter's various activities could be conducted with greater efficiency and profit if separately incorporated and that with the increasing volume of engineering and construction work the company is now carrying on additional capital could be used advantageously if the two departments were separate entities. The total authorized capital stock of The J. G. White Engineering Corporation is to be $2,000,000, of which $1,000,000 is to be common stock and $1,000,000 is to be 7 per cent cumulative preferred. All of the common stock will be owned by J. G. White & Company, Inc., in return for all of the assets of the latter's engineering department, which will be transferred shortly to the new engineering corporation. J. G. White & Company, Inc., will subscribe presently for $500,000 of the preferred stock at par, leaving $500,000 unissued for future requirements. Of the $500,000 subscribed for by J. G. White & Company, Inc., $350,000 will be offered to present stockholders of the latter at par. Each stockholder is to have the right to take preferred stock in the new engineering corporation to the extent of 10 per cent of the par value of his present holdings of preferred and common. A bonus of common stock of J. G. White & Company, Inc., will be given with the preferred stock, amounting to 10 per cent of the latter subscribed for. The balance of the $500,000 subscribed for by J. G. White & Company, Inc., but not taken by the stockholders will be offered to directors of the new corporation. The J. G. White Management Corporation will have an authorized capital stock of $1,000,000, divided into $500,000 common and $500,000 7 per cent cumulative preferred stock. All of the common stock will be issued to J. G. White & Company, Inc., and all of the assets of the latter's present operating department will be turned over to the new management concern. Of the preferred, $350,000 will be subscribed for by J. G. White & Company, Inc., at par, and this will be offered to the present stockholders upon the same terms, including the bonus, as the offering to them of the stock of the management corporation, described above, will be made, and the balance not subscribed for by stockholders will be offered to directors of the new corporation. The $150,000 unissued will be used for future requirements. A meetings of the stockholders of J. G. White & Company, Inc., will be held on Dec. 10, to approve the segregation plan. The balance sheet of J. G. White & Company, Inc., as of Sept. 30, 1912, shows total assets and liabilities of $4,820,927, as follows: Assets—Good will, plant, tools, instruments, etc., $1,499,037; deferred charges and plant, less depreciation, $78,846; securities owned and syndicate participations, $2,330,513; bills receivable, $109,513; accounts receivable, $500,997; interest and dividend accrued, $25,211; cash on hand and in banks, $258,363; working capital and cash in branch offices, $18,447; total assets, $4,820,927. Liabilities—Capital stock issued, common $1,500,000, preferred $2,000,000; bills payable, $34,396; accounts payable, $23,407; surplus, Feb. 29, 1912, $605,522; profit for seven months ended Sept. 30, 1912, $687,602; total surplus, less preferred dividend No. 37, of $30,000, $1,263,124; total liabilities, $4,820,927.

Scope of 1912 Work Done by J. G. White & Company, Inc.—Construction work done by the engineering department of J. G. White & Company, Inc., thus far in the current year has aggregated $28,000,000 in cost and has been distributed throughout thirty different states and Canada. Among the work accomplished were the complete rehabilitation of several existing public service properties, the construction and equipment of two high-speed interurban electric railways, the engineering for the drainage of 118,000 acres in Florida and the design and construction of a 124-mile, 12-in. natural-gas pipe line from Bakersfield to Los Angeles, Cal., in which the operating pressure will be 450 lb. per square inch. Among the hydroelectric developments constructed by the company's engineering department are those of the New England Power Company on the Deerfield River near Shelburne Falls, Mass.; the stations for the Georgia-Carolina Power Company on the Savannah River, near Augusta, Ga.; the station for the Columbia (S. C.) Railway, Gas & Electric Company, on the Broad River at Parr Shoals; the developments of the Eastern Tennessee Power Company, on the Ocoee River, at Parkville, Tenn.; the development for the San Joaquin Light & Power Company in California and hydroelectric work on the Beauharnois Canal in Canada. The aggregate rating of these water-power sites is 250,000 hp. In addition to the foregoing, the company has made appraisals and reports during the year upon properties aggregating in value more than $400,000,000 in all parts of the United States and Canada. The various activities of the company's management department include the operation of a number of public utilities such as the electric railway and lighting properties at Manila, P. I.; electric light and traction properties at Augusta, Ga., and public utilities at Helena, Mont. The department also acts as operating manager for the Associated Gas & Electric Company, which controls several gas and electric properties in the States of New York, Pennsylvania and Ohio, and also acts as consulting operating manager of the United Light & Railways Company of Grand Rapids, Mich., and of numerous other public utility properties.

Western Electric's October Business.—In the ten months of the current year ended Oct. 31 the Western Electric Company billed 5 per cent more goods than in the same period of 1911. From present indications, the record of the year as a whole will show a total of goods billed slightly more than the estimate of $67,000,000 that was made at the beginning of 1912. The business of the company last year totaled $66,000,000, which is within $3,000,000 of the best year of its history, so that if the present rate of business is maintained the 1912 total will be only about $2,000,000 under the best showing made in the past. In some localities in the East and in a greater number in the West the October business of the company was not so good as it was in the corresponding months last year. Incoming business was not so large as the billing, which consequently reduced the amount of orders on hand. The company now has about 22,000 employees on its payrolls. No notable increases in

business are expected by the officers of the company in the remaining two months of the fiscal and calendar year.

Tennessee Railway, Light & Power Outlook.—F. C. Walcott, of William P. Bonbright & Company, 14 Wall Street, New York, accompanied by C. M. Clark, of E. W. Clark & Company, and two engineers, recently made an inspection of the properties of the Tennessee Railway, Light & Power Company, and of the territory which its lines will traverse, and found that the situation as a whole was fully as promising as it appeared to be when the company was organized. The prospects for supplying a large amount of energy in Nashville to the many industrial plants of that city and vicinity the party found to be exceedingly bright. An increase in gross revenue from motor-service customers amounting to about $445,000 appeared to be in sight. Mr. Walcott estimates that 30 per cent of this new business will be secured in 1913. Full benefits of the Nashville market have not been realized by the company as yet, since the business already in hand has absorbed all of the energy now available for motor-service purposes; but an adequate supply of energy for industrial purposes will probably be available by next June, and much of the additional load now in sight will then be placed upon the system. Inspection of the territory between Nashville and Chattanooga showed good prospects for new business in the outlying districts. Business conditions and prospects for a large motor-service load in Chattanooga were found to be excellent. The low rates at which the company's service is now available in that city and the spirit of progressiveness and prosperity that the inspection party found on all sides assure the development of a large industrial load in this part of the company's territory. The hydroelectric developments on the Ocoee River were found to be progressing satisfactorily. Site No. 1 is now carrying a peak load of 10,500 hp, and an additional 5000 hp will be ready for installation by January, from present indications. The site has 20,000 hp available. A contract has been made with the Aluminum Company of America calling for the delivery of 20,000 hp in electrical energy, which insures an immediate market for the output from development No. 2. This development is now about one-half completed and will probably be placed in operation by next July. From the contracts already made and the new business in sight, it is possible that the third development, which will provide 30,000 hp, will be needed sooner than had been expected. The transmission line between Chattanooga and Nashville by way of Great Falls will be completed about April 1. Knoxville and Cleveland, Tenn., and Rome, Ga., are being served with energy from the Ocoee River development.

Montana Public Utilities Consolidated.—Subject to the approval of the stockholders at a meeting to be held on Dec. 12, the directors of the Butte (Mont.) Electric & Power Company have agreed upon the consolidation of that company with the Missouri River Electric & Power Company, the Madison River Power Company and the Billings & Eastern Montana Power Company, and with the Montana Power Company. All the capital stock of these corporations, with the exception of that of the last-named, is owned by the Butte company. The Montana Power Company was incorporated under New Jersey laws in October, 1912, as noted in these columns Nov. 9. It has an authorized capital stock of $3,900,000. The consolidated corporation will be called The Montana Power Company and will have an authorized capital stock of $100,000,000. Of this, $25,000,000 will be 7 per cent cumulative preferred and $75,000,000 will be common stock. The Montana Power Company will be controlled by the same interests which have conducted the affairs of the Butte Electric & Power Company in the past. These include John D. Ryan, John G. Morony, Max Hebgen, C. F. Kelly and Marcus Daly, of Montana; C. W. Wetmore, C. H. Sabin, C. A. Coffin, S. Z. Mitchell and Seligman & Company, of New York; G. M. Lane, of Boston; J. G. Schmidlapp, of Cincinnati, and Robert Flenning, Son & McLeod, of London. C. W. Wetmore is to be president and Max Hebgen, of Butte, vice-president and general manager. Extensive hydroelectric developments to cost over $12,000,000 are under consideration.

Telluride Power Company Sold at Auction.—On Nov. 18 the property of the Telluride Power Company was sold at Telluride, Col., to Niel A. Weathers, in the interest of the recently organized Utah Securities Corporation, for $6,460,000, and will be transferred to the Utah Power & Light Company, a subsidiary of the Utah Securities Corporation. L. L. Nunn, former president and general manager of the Telluride company, obtained a temporary injunction in the federal courts in Denver, on Nov. 16, against the sale of the company, charging, it is said, conspiracy and attempts to defraud and claiming that the property was worth at least $10,000,000. Mr. Nunn, however, failed to put up adequate bond in accordance with the order of the court, and the sale went forward on Nov. 18 as above. When the Telluride company was reorganized a few months ago, as noted in these columns Aug. 3 and 21, control of the property passed to J. R. Nutt, of the Citizens' Savings & Trust Company, Cleveland, and to interests associated with the North American and the Electric Bond & Share companies. Following this change and the election of new directors and officers for the Telluride company, Mr. Nunn resigned. It is stated that he held only a small amount of stock.

New York Central May Sell Its Gas and Electric Properties.—It is understood that an Eastern banking syndicate has secured an option at $125 a share on a majority of the holdings of the New York Central & Hudson River Railroad Company in the Mohawk Valley Company, amounting to $5,114,300 of the $7,500,000 outstanding common stock. In addition to the Rochester (N. Y.) Railway & Light Company, the Mohawk Valley Company controls a number of other public-utility concerns in the upper part of New York State. The Mohawk Valley Company was incorporated in 1905 by the New York Central-Andrews syndicate as a holding company and took over control of practically all the electric railway and lighting properties which had been acquired by the New York Central & Hudson River Railroad Company. When the New York State Railways Company was incorporated in 1909 the control of the traction properties was transferred to it, so that the Mohawk company now controls only the lighting properties. These are the Canandaigua Gas Light Company, the Despatch Heat, Light & Power Company, the Eastern Monroe Electric Light & Gas Company and the Rochester Railway & Light Company. It is stated that the New York Central does not care to operate lighting properties any longer. Mr. Andrews would not make any statement this week relative to the above.

Electric Investment Corporation Organized.—The Electric Investment Corporation has just been organized under Virginia laws with an authorized capital stock of $1,500,000, of which $1,000,000 is preferred and $500,000 is common, for the purpose of acquiring and dealing in securities of all kinds, and particularly those of public-service corporations. Under its charter it may also engage in the development and operation of hydroelectric and other public-utilty properties. The officers of the company are: President, George A. Galliver, president of the Central States Electric Corporation, 60 Broadway, New York; vice-president, E. P. Chalfant, president of the Springfield Railway & Light Company, and treasurer, A. Keshishian. These, with the following, are directors of the Electric Investment Corporation: R. E. Breed, president of the American Gas & Electric Company; Anson W. Burchard, of the General Electric Company; Alfred Gregory, of Hawkins, Delafield & Longfellow, attorneys, New York; W. L. McKee, vice-president of the Central States Electric Corporation; Oren Root, president of the Republic Railway & Light Company, and Harrison Williams, prominently identified with the public utility field.

Baker Motor Vehicle's Business Is Increasing.—In the month of October last the sales made by the pleasure car department of the Baker Motor Vehicle Company, Cleveland, Ohio, showed a net increase over those made in October, 1911, of 123 per cent. This is 36½ per cent in excess of the total sales in April, 1911, which heretofore made the largest monthly total in the history of the Baker company. The latter is now going ahead with building plans and operations which will increase the size of its factory by about 30 per cent. The greater part of the new buildings will be occupied by the truck department. The Baker company has just delivered twenty 1-ton trucks to the St. Paul Bread Company and six trucks to Woodward & Lothrop's department store, Washington, D. C.

Southwestern Gas & Electric Bonds.—In connection with an offering of first and refunding mortgage twenty-year 5 per cent sinking-fund gold bonds of the Southwestern Gas & Electric Company, Henry M. Dawes, president of the company, gives some data which may be of interest. He states that the company does the entire gas and electric lighting business in the city of Shreveport, La., and its suburbs and the entire gas, electric-lighting and street-railway business in Texarkana, Tex., and Texarkana, Ark. It also owns valuable natural-gas properties and is furnishing natural gas in Shreveport and Texarkana. The company has an authorized common stock of $3,000,000, of which $2,242,000 is outstanding, and $2,500,000 preferred stock, of which $1,174,000 is outstanding. It has an authorized issue of $7,500,000 first and refunding-mortgage sinking-fund 5's, of which $3,000,000 are outstanding. Of the latter, $867,000 are reserved with the trustees for the purpose of retiring $423,500 Shreveport Gas, Electric Light & Power Company's 5's, due Oct. 1, 1922, and $443,500 Texarkana Gas & Electric Company's 5's, due July 1, 1930. The remaining $4,500,000 are reserved in escrow with the trustees to be issued from time to time for not exceeding 80 per cent of the actual and reasonable cost of permanent extensions and enlargements.

Upper New York State Company to Enlarge.—The Salmon River Power Company has asked authority from the Public Service Commission of the Second New York District to acquire and exercise franchises now held by the Pulaski Electric Light Company for electrical distribution in Richland, Orwell and Albion, Oswego County. The company also asked approval to exercise similar franchises in the towns of Parish and Hastings and the villages of Altmar and Central Square, Oswego County, and in the towns of Cicero, Clay and Salina, Onondaga County. It is stated that the Salmon River company is constructing a power plant in the town of Orwell with transmission lines to the village of Solvay, where they will connect with the transmission lines of the Niagara, Lockport & Ontario Power Company, which company recently acquired control of the Salmon River Power Company.

Great Western Power Financing.—Relative to an inquiry as to whether the Great Western Power Company would issue additional bonds shortly, Mortimer Flieshhacker, president of the company, was quoted this week as follows: "We have ample funds on hand to carry along all the development work that can be done until the first of the year and perhaps for some time afterward. We are not selling any bonds now for the reason that there is no need to do so. To complete the plans of Great Western Power in projects on hand and under consideration will require much money. This money we get largely from the East and we prefer to have our securities go into non-speculative hands. A good many millions of dollars will go into Great Western Power before it is shaped up."

Montpelier Properties Consolidated.—Announcement has been made at Boston that the Tenney interests, now controlling important central-station properties at Holden, Fitchburg, Haverhill and Salem, Mass., and other points in New England and the East, have organized under Massachusetts laws the Montpelier & Barre Light & Power Company, to supersede the Vermont Power & Lighting Company and the Consolidated Lighting Company, now operating in the Montpelier-Barre district. The authorized capital is $2,100,000, covered in 11,000 shares of 6 per cent cumulative preferred stock and 10,000 share of common stock. The properties include several hydroelectric and steam plants, high-tension transmission lines and distribution circuits supplying energy to the famous Barre quarrying establishments.

General Electric Sales Ahead of Last Year's.—Sales of the General Electric Company are maintaining the increase which began some three months ago. Orders at this time are about 20 per cent larger than those in the corresponding period of 1911. It is now expected that this year's sales will total between $94,000,000 and $95,000,000. It is believed, however, that while gross earnings will show a considerable increase over those of 1911, the net earnings will not show a proportionate gain, owing to the inability to get prices in keeping with the ascending trend of raw material cost.

Files $30,000,000 Mortgage in Texas.—The Texas Power & Light Company, of Dallas, formed last June by the Electric Bond & Share Company, of Broadway, New York, has purchased the El Paso Gas & Electric Company, and will enlarge the plants and distributing system. The Texas Power & Light Company has filed a mortgage with the Bankers' Trust Company of New York for $30,000,000 to permit the issuance of such bonds as may be required to furnish capital for the improvements and extensions to be made at its various properties.

Springfield (Ohio) Light, Heat & Power Company Sold.—Interests represented by Hodenpyl, Hardy & Company, 7 Wall Street, New York, have taken over the Springfield (Ohio) Light, Heat & Power Company. Reference to the option which the purchasers secured on the stock of this company appeared in these columns on Oct. 5.

To Hasten Allis-Chalmers Reorganization.—Judge Geiger in the United States District Court at Milwaukee issued an order on Nov. 18, in response to a petition by Otto H. Falk, receiver for the Allis-Chalmers Company, directing that the claims of all creditors of the company shall be filed on or before Feb. 15, 1913.

Illinois Public Utilities Sold.—It is reported that the Central Illinois Public Service Company, of Mattoon, Ill., has purchased the Marion (Ill.) Light, Water & Power Company and also the central-station properties at Johnson City, Carterville, Herrin, Harrisburg, Carbondale and Anna, Ill.

Seeks to Purchase Ohio Utility.—The Valley Light & Power Company of Toledo, Ohio, has asked the Ohio Public Service Commission to give it authority to purchase the property of the Suburban Light & Power Company, of Maumee. The purchase price is given as $161,200.

Western Telephone & Telegraph Dissolution.—The Western Telephone & Telegraph Company has been formally dissolved and its property has been sold to the American Telephone & Telegraph Company, which has assumed its obligations.

NEW YORK METAL MARKET PRICES.

	Nov. 12 Bid.	Nov. 12 Asked.	Nov. 19 Bid.	Nov. 19 Asked.
Copper:				
Standard, spot	17.00	.....	17.20	17.50
	£ s d		£ s d	
London, standard, spot	76 7 6		77 18 9	
Prime Lake	17.50 to 17.65		17.75	
Electrolytic	17.37½		17.62½	
Casting	17.20 to 17.30		17.45	
Copper wire, base	19.00		19.00	
Lead	4.75		4.75	
Nickel	45.00		45.00	
Sheet zinc, f.o.b. smelter	9.00		9.00	
Spelter, spot	7.50		7.50	
Tin, spot	49.60		49.62½	
Aluminum:				
Prompt delivery	27.00 to 28.00		26.00 to 26.50	
Future	26.00 to 26.50		26.00	

OLD METALS.

Heavy copper and wire	16.00	16.75
Brass, heavy	10.00	10.00
Brass, light	8.75	8.75
Lead, heavy	4.40	4.40
Zinc, scrap	6.12½	6.12½

COPPER EXPORTS IN NOVEMBER.

Total tons, week ending	Nov. 12, 4,789	Nov. 19, 8,657

INDUSTRIAL SECURITIES.

Security.	Capital Stock Listed.	Dividend. Per Cent.	Dividend. Period	Quotation. Nov. 13	Quotation. Nov. 20
Allis-Chalmers, 2d assess. paid	$17,151,100	.....	.....	3*	2⅞*
Allis-Chalmers, pf., 2d assess. paid	14,034,700	.....	.....	10*	10*
Amalgamated Copper	153,887,900	1	Q	84½	85
American Tel. & Tel.	334,712,300	2	Q	143¼	142¾
Crocker-Wheeler, c.	1,700,000	1½	Q	85*	86*
Crocker-Wheeler, pf.	500,000	1¾	Q	105*	105*
Electric Storage Battery, c.	16,074,425	.....	.....	54½	54⅞
General Electric	77,726,700	2	Q	180¾*	182*
Mackay Cos., c.	41,380,400	1¼	Q	85⅝	85⅞*
Mackay Cos., pf.	50,000,000	1	Q	68½*	68
Western Union Tel.	79,943,400	¾	Q	77½	78*
Westinghouse, E. & M., c.	31,685,300	1	Q	80¾	80½
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	123*	123*

*Last price quoted.

Personal

Mr. L. W. Layman, of the Rochester (N. Y.) Railway & Light Company, has been appointed head of the company's trouble department.

Mr. G. F. Taylor, well-known electrical inspector of Memphis, Tenn., will deliver a number of addresses on electrical subjects before the Fire Insurance Club of Memphis during the coming winter.

Mr. F. R. Slater, recently of the firm of Messrs. Latey & Slater, engineers, New York City, has been appointed general superintendent of the Texas Power & Light Company, with headquarters at Dallas, Tex.

Mr. W. M. Case, for many years superintendent of the Clarksville (Tenn.) Railway & Light Company, has become associated with the Americus (Ga.) Gas & Electric Company, succeeding Mr. J. H. Hagerty.

Mr. W. S. Burch, formerly connected with the General Electric Company in its steam-turbine-testing department, has joined the industrial engineering staff of the Rochester Railway & Light Company, Rochester, N. Y.

Mr. John W. Cooke, chief operating engineer of the Electric Storage Battery Company in New England, gave a lecture on storage batteries from the engineering standpoint at the Franklin Union, Boston, on Nov. 18.

Mr. D. L. Evans, superintendent of construction of the Monongahela Valley Traction Company, Fairmont, W. Va., has resigned to accept a position as manager of the new Martinsville (W. Va.) Electric Light & Power Company.

Mr. R. F. Schuchardt, electrical engineer of the Commonwealth Edison Company, Chicago, delivered an illustrated address on the Panama Canal before the Chicago Tau Beta Pi Association at its annual banquet, Hotel Stratford, Chicago, Nov. 12.

Mr. B. E. Sunny, president of the Chicago Telephone Company, is a director of the recently organized National Citizens' League, the purpose of which is to carry on a campaign of education for an improved banking system for the United States.

Mr. Oren Root, formerly general manager of the Metropolitan Street Railway, New York, has been elected president of the Republic Railway & Light Company, in place of **Mr. James Parmelee,** resigned. Mr. Root's headquarters will be in New York.

Mr. A. B. Carey, resident engineer of the Vancouver Island Power Company, Victoria, B. C., was presented with a silver tea-set by the members of the staff engaged on the Jordan River power development on the occasion of his leaving the service.

Mr. J. H. Cochran, formerly manager of the George G. Fetter Lighting & Heating Company, a Louisville company recently bought in by Messrs. H. M. Byllesby & Company, has been appointed superintendent and chief engineer of the acquired property.

Mr. H. P. Rust, honor graduate of the University of Toronto, and son of Mr. C. E. Rust, formerly city engineer of Toronto, Ont., has been appointed engineer in charge of one of the developments of the Great Western Power Company, San Francisco, Cal.

Mr. William H. Hulswit, who has been temporarily acting as manager of the Iowa City (Ia.) Gas & Electric Company, has been appointed assistant to the president of the United Light & Railways Company, Grand Rapids, Mich. Mr. Hulswit will establish his office in Chicago.

Mr. Fred R. Lufkin, formerly an instructor in electrical engineering at the Massachusetts Institute of Technology, Boston, and late assistant superintendent of lighting and wires at Brookline, Mass., has joined the staff of Mr. Walter B. Snow, publicity expert of Boston.

Mr. Marshall B. Downing, district manager of the New York Telephone Company at Newark, N. J., has accepted a position as superintendent of traffic of the Missouri Bell Telephone Company at St. Louis. **Mr. J. W. Hubbell,** Brooklyn, N. Y., has been appointed to succeed him.

Mr. H. N. Latey, at one time a member of the engineering department of the Interborough Rapid Transit Company, New York, and more recently a member of the firm of Messrs. Latey & Slater, has entered the employ of the General Electric Company, which has assigned him to its railway department.

Mr. Glenn C. Webster, formerly manager of the engineering department of the National Electric Lamp Association, Cleveland, Ohio, has been appointed general manager of the Tungstolier Works of the General Electric Company, Conneaut, Ohio. Mr. Webster succeeds **Mr. E. J. Kulas,** who has resigned to take up other work.

Mr. John J. Carty, chief engineer of the American Telephone & Telegraph Company, has been created a member of the Order of the Sacred Treasure by the Emperor of Japan. Mr. Carty already wears the decoration of the Order of the Rising Sun, conferred by the late Emperor after the close of the war between Japan and Russia.

Mr. Andrew N. Fox, advertising manager of the Benjamin Electric Manufacturing Company, Chicago, was recently elected a director of the Chicago Advertising Association, which is erecting a new twelve-story office building on West Madison Street, known as the Advertising Building and said to be the first bulding in the word to be devoted exclusively to advertising interests.

Mr. P. W. Sothman, formerly chief engineer of the Hydro-Electric Power Commission of Ontario, has been engaged by Canadian capitalists to report on the construction of a 110,000-volt transmission line for a Mexican power company. Mr. Sothman will be engaged in this work for a period of six weeks and will return from Mexico by way of Utah to report on a 130,000-volt line to be built in the latter State.

Mr. W. B. Tuttle, vice-president and general manager of the San Antonio (Tex.) Gas & Electric Company, was appointed by the American Society of Mechanical Engineers to represent the society at the recent dedication exercises of the Rice Technical Institute, Houston, Tex. Mr. Tuttle is one of the leaders in the Southwestern Gas and Electric Association, which he served in 1909 as vice-president and in 1910 as president.

Mr. Roger N. Kimball, Kenosha manager for the Wisconsin Gas & Electric Company, has resigned from that company to engage in mercantile business. Mr. Kimball was vice-president and manager of the Kenosha (Wis.) Gas & Electric Company, which was absorbed by the Wisconsin Gas & Electric Company. He has been active in the affairs of the Wisconsin Electrical Association, of which he is vice-president.

Mr. C. O. Mailloux, president of the United States committee of the International Electrotechnical Commission, will leave for Europe shortly to attend a meeting of the commission at Zurich, Switzerland, on Jan. 13. While abroad Mr. Mailloux, as vice-president on international arrangements for the International Electrical Congress at San Francisco in 1915, will also extend invitations to foreign scientific and technical societies to attend the congress.

Mr. Charles F. Howe, formerly engineer of the Central Georgia Power Company and its allied interests, has started consulting engineering practice in Macon, Ga. Mr. Howe has been actively engaged in the investigation and development of water-powers in the South, particularly in Georgia and Alabama, for the past ten or twelve years. He had much to do with the development of the Central Georgia Power Company, the Macon Railway & Light Company, the Central Georgia Transmission Company and the Flint River Power Company, for all of which companies he has been retained as consulting engineer.

Obituary

Mr. William N. Hobart, president of the Triumph Electric Company, Cincinnati, Ohio, died on Nov. 15 in his seventy-sixth year. Although Mr. Hobart had not taken a very active part in the management of the company during the past few years, his loss as a counselor and friend will be keenly felt. Mr. Hobart had always been an indefatigable worker and has been identified with the directorate of several of the most important business houses in Cincinnati. He was also interested in the promotion of music and art and for ten years was president of the May Festival Association.

Construction

FLORENCE, ALA.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 12, for the installation complete of an electric elevator in the United States post office in Florence, Ala., in accordance with plans and specifications copies of which may be obtained at the above office or at the office of the custodian. Oscar Wenderoth is supervising architect.

ROOSEVELT, ARIZ.—Surveys have been completed by Mr. Farish, of Mesa, for the installation of a power plant, about 8 miles west of the Roosevelt dam.

McGEHEE, ARK.—Sealed bids will be received by the Commissioners of Water and Light Improvement District until Dec. 16 for furnishing all materials, equipment and labor for the construction of a water-supply and electric-light system for the town of McGehee. Plans and specifications are on file in the office of G. B. Ewing, secretary board of commissioners, and at the office of the Missouri Valley Engineering Co., Mitchell, S. D. Copies of plans and specifications may be secured on application to the engineers upon deposit of $15, which will be refunded upon return of plans. Scott McGehee is chairman of board of commissioners.

BALBOA, CAL.—The recent issue of bonds for a municipal electric-light and power plant having been declared invalid as issued, a second issue is now being made for the same purpose.

CHICO, CAL.—Preliminary engineering work is being done for the proposed hydroelectric plant on Deer Creek, 35 miles northeast of Chico. Dennis Murphy, of Chico, owns the water rights of this project.

KELSEYVILLE, CAL.—The Mount Konocti Lt. & Pwr. Co., of Lakeport, has extended its transmission lines to Kelseyville and is now supplying electricity here. The company hopes to complete its system here in time to get a good start on its proposed line to Upper Lake and Scott's Valley this season.

LODI, CAL.—Electroliers will be erected on the principal streets in Lodi in the near future.

LOS ANGELES, CAL.—The Pacific Lt. & Pwr. Corpn. has applied to the State Railroad Commission for permission to extend its electrical system in the city of Eagle Rock.

LOS ANGELES, CAL.—The City Council has given its approval to the plan for the installation of an ornamental street-lighting system on Main Street from Pico to Moneta Avenue. The work will be done on the assessment district plan.

LOS ANGELES, CAL.—Work will begin at once on the installation of the lighting system on the boulevard, known as the Sherman Way, which will extend from the east end of the boulevard at Encino Avenue to the Ventura Road, a distance of 16¼ miles. About 400 standards carrying cluster lamps will be required. The style and character of standards and lamps have not yet been decided upon. An appropriation of $75,000 has been made to install the system.

LOS ANGELES, CAL.—The Board of Public Works has given its approval to the contract whereby the Aqueduct Power Bureau is to construct a power distrbuting line to the plant of the Saline Valley Salt Co., in the Saline Valley, easterly from Owens Valley. The company is to advance $5,000 for this work and the line is to be its property but is to be used exclusively for the transmission of aqueduct power for its own use and to supply other concerns along the route which may wish to use aqueduct power.

POMONA, CAL.—The directors of the Pomona Valley Tel. & Teleg. Co. have voted to issue $200,000 in bonds for extensions and improvements to its system. The bond issue will be submitted to the State Railroad Commission for approval.

RIVERSIDE, CAL.—N. A. Ross and A. F. Stearns, of Los Angeles, have acquired a tract of eight acres east of Riverside near Box Springs and will install several electrically operated pumping plants on the property.

SAN FRANCISCO, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 6, 1913, for construction of the United States Sub-Treasury building including plumbing, gas piping, heating apparatus, electric conduits and wiring, vacuum-cleaning system and lift, in San Francisco. Drawings and specifications may be obtained from J. Milton Dyer, architect, Cuyahoga Buidling, Cleveland, Ohio, and from J. W. Roberts, supervising superintendent of construction, 403 Post Office and Court House Building, San Francisco. Oscar Wenderoth is supervisng architect.

DENVER, COL.—Plans for immediate improvements, involving a total expenditure of $9,000,000 by the railroad and $4,000,000 by electric power companies, have been authorized by President B. F. Bush and Vice-President E. L. Brown of the Denver & Rio Grande R. R. Co. Contracts will be awarded within the next 15 days for the construction of the double-track detour line over Soldier Summit, 15 miles in length. This improvement will cost about $3,000,000. Work will begin on equipping the Salt Lake division, from Helper to Salt Lake, 115 miles, for electrical operation as soon as the cut-off over Soldier Summit is completed. The next unit to be equipped for electrical operation will be the main line between Minturn and Salida, crossing the Tennessee Pass. If justified by results, the work will continue until the entire mountain district is operated by electrical power.

WASHINGTON, D. C.—The bid of the Ridgway Dynamo & Engine Co., Ridgway, Pa., for furnishing switchboard and generator sets for laundry plant at Schofield Barracks, Hawaii, has been accepted by the depot quartermaster, U. S. A., Washington, D. C.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the chief signal officer, War Department, Washington, D. C., until Nov. 29 for furnishing the signal corps with one telephone switchboard, common battery, 100 heat coils, 100 pairs carbon, 100 micas, one distributing and protecting frame, three switchboards and distributing frame, one 2-kw radio station equipment and one 1-kw radio station equipment. Specifications and further information may be obtained for above proposals (Nos. 621 and 622) by addressing chief signal officer of U. S. A.

BRADENTOWN, FLA.—Bonds to the amount of $75,000 have been voted for the installation of an electric-light plant, extensions to waterworks, sewerage and drainage systems, etc.

GREEN COVE SPRINGS, FLA.—Bonds to the amount of $5,000 have been voted for improvements to the light and water plant.

DECATUR, GA.—Preparations are being made by the Georgia Ry & El. Co. to construct a substation on College Avenue, Decatur, 50 ft. x 150 ft., two stories high.

EATONTON, GA.—The City Council has decided to call an election to vote on the proposition to issue bonds for the erection of a municipal electric light and power plant, plans for which were prepared by the Solomon-Norcross Co., engineer, Atlanta, Ga. L. M. Pennington is Mayor.

LAVONIA, GA.—The J. B. McCrary Co., of Atlanta, has been granted a franchise by the Town Council to install an electric-light system here.

ALEDO, ILL.—The cluster light committee of the Retail Merchants' Association has awarded the contract for 54 ornamental lamp standards to the Murray Iron Works, of Burlington, Ia. The contract for installing and equipping the posts has been awarded to the Aledo El. Lt. Co. Each standard will carry four 40-watt lamps and one 60-watt lamp. The City Council has agreed to furnish electricity to maintain the lamps.

ALVIN, ILL.—The Village Board contemplates the use of electricity for lighting the streets of the village. Electrical energy for the system may be secured from Hoopeston or Potomac, Ind.

BATAVIA, ILL.—The Aurora, Elgin & Chicago R. R. Co. has submitted a propostion to the City Council offering to light the streets of the city and also asking for a franchise to sell electricity for commercial purposes in Batavia. Edwin C. Faber, of Wheaton, Ill., is general manager.

BRACEVILLE, ILL.—The Public Service of Northern Illinois, of Chicago, is seeking a contract to light the streets of this village.

CARTHAGE, ILL.—The Middle West Utilities Co. of Illinois, of Chicago, has purchased the electric plant of the Carthage El. Lt. & Htg. Co.

CHATSWORTH, ILL.—The Village Council has granted the Central Illinois Utilities Co. a franchise to operate an electric-light system here for a period of 30 years.

CHICAGO, ILL.—The Middle West Utilities Co. of Chicago has changed its name to the Middle West Utilities Co. of Illinois.

DECATUR, ILL.—John D. Barnhart and Dr. W. H. Bell are interested in a project to install ornamental street lamps on North Water Street.

EARLVILLE, ILL.—Bids will be received by the W. H. Zimmerman Co., engineers, 903 First National Bank Bldg., Chicago, until Nov. 29, for furnishing and installing one electrically operated deep-well pump and one electrically operated fire pump, including foundations, piping, etc., in the city water-works plant at Earlville. Bids will be opened at a meeting of the City Council at Earlville on Dec. 2. Specifications may be obtained at the office of the W. H. Zimmerman Co.

FREEPORT, ILL.—The capital stock of the Stephenson County Tel. Co.. has been increased from $150,000 to $450,000.

FREEPORT, ILL.—The Freeport Ry. & Lt. Co. has signed an agreement with the Park Board to the effect that it will extend the street railway line to Krape Park as soon as the city acquires the property.

MOLINE, ILL.—The voters of the city have approved the proposition to allow the Tri-City Ry. & Lt. Co., of Davenport, Ia., to change the course of the interurban railway in this city and to construct a new line on Seventh Street.

PERU, ILL.—The City Council has rejected the proposal of the Northern Illinois Lt. & Trac. Co., of Ottawa, to furnish electricity for street lighting here. The defeat of this proposition is said to mean that the municipal electric-light plant will be enlarged and new equipment installed so as to extend the street-lighting system to the outlying districts of the city.

ROCK ISLAND, ILL.—The city commission is experimenting with 100-watt lamps, which may be substituted for the 2000-cp arc lamps in the residential district.

ROSEVILLE, ILL.—The local electric-light plant, owned by Messrs. Carr & Lee, has been purchased by the Central Illinois Pub. Ser. Co., of Mattoon.

SHELBYVILLE, ILL.—The City Council has instructed H. M. Brown, manager of the municipal electric-light plant, to purchase material for extension of the ornamental street-lighting system seven blocks on Main Street.

SPRINGFIELD, ILL.—The McKinley Interurban syndicate has filed notice of increase in the capital stock of a number of utility properties belonging to it as follows: The Urban & Champaign Ry., Gas & El. Co., from $500,000 to $750,000; the Urbana Lt., Ht. & Pwr. Co., from $100,000 to $150,000; the Decatur Ry. & Lt. Co., from $1,300,000 to $1,375,000; the Peoria Ry. Co., from $1,000,000 to $1,010,000; the Madison County Lt. & Pwr. Co., Edwardsville, from $100,000 to $135,000.

BLUFFTON, IND.—The question of retaining or selling the municipal electric-light plant will be submitted to the voters on Nov. 29. If it is decided to hold the plant, extensive improvements will be necessary to enable it to meet the demand upon it.

CONNERSVILLE, IND.—Extensive improvements are to be made to the plant of the Lt., Ht. & Pwr. Co., which will involve an expenditure of at least $125,000. The work will include the installation of a 750-hp turbine, which has been purchased; new boilers, a complete automatic stoking apparatus and other changes.

CROWN POINT, IND.—The Calumet El. Co. has filed notice with the Secretary of State of increase in capital stock from $10,000 to $200,000. The company is preparing to make extensions and improvements to its plant. Considerable new machinery will be installed.

ELKHART, IND.—W. A. Stanton has been appointed by the Retail Merchants' Association to investigate ornamental lighting systems in use in various cities and to report at the December meeting of the association.

MORRISTOWN, IND.—The Town Board is preparing to ask for bids for lighting the town by electricity.

SHERIDAN, IND.—The Sheridan Lt., Ht. & Wtr. Co. has issued $25,000 in capital stock, the proceeds to be used for improvements and extensions to its plant. New machinery will be installed.

UNION CITY, IND.—The Union Lt., Ht. & Pwr. Co. has increased its capital stock from $50,000 to $200,000, the proceeds to be used for improvements, extensions and installation of new machinery in its plant. George W. Pitchell is president and W. W. Goodrich secretary.

WEST LEBANON, IND.—Bids will be received until Dec. 3 for the construction of an electric-light plant, to cost about $5,000. John James is town clerk.

ADEL, IA.—The County Commissioners have granted the Adel Mill Co. permission to erect transmission lines along the county roads.

FREDERICKSBURG, IA.—At the election held Nov. 4 the proposition to issue $4,500 in bonds for the construction of a municipal electric-light plant was carried. H. S. Kersner is clerk.

MOUNT VERNON, IA.—The Iowa Ry. & Lt. Co., of Cedar Rapids, will install a substation here for its Mount Vernon extension. Electricity will be transmitted from the generating station at the Cedar Falls station at 16,500 volts.

PERRY, IA.—The Hawkeye Tel. Co. has decided to install a complete new local system, to cost from $20,000 to $25,000. The central energy system will be used.

CHENEY, KAN.—An election will be held this month to submit the proposition to issue $30,000 for the installation of an electric-light plant and water-works system to the voters. Rollins & Westover, Midland Building, Kansas City, are engineers.

WHITEWATER, KAN.—The Whitewater Milling & Elevator Company is planning to install an electric plant. The Council will grant the company a franchise and contract for 30 street lamps. R. H. Farr is manager.

HENDERSON, KY.—Extensions will be made to the municipal electric-light plant, including the installation of an additional 750-kw turbine. Plans also provide for the erection of a chimney, 250 ft. x 126 in., during the coming year. L. P. Hite, superintendent, will have charge of the work.

OAK BLUFF, MASS.—The Oak Bluff St. Ry. Co. expects to purchase a 500-hp condenser before Dec. 15. C. H. Carpenter is superintendent.

SPRINGFIELD, MASS.—Contracts have been awarded by the Municipal Building Commission for lighting fixtures for the municipal group, amounting to $48,228, as follows: Exterior and interior fixtures for the auditorium, office building, tower, sidewalks and court, awarded to Edward F. Caldwell Co., 36 West Thirty-seventh Street, New York, N. Y., for $36,180; general fixtures for auditorium and office building, to the Sterling Bronze Co., 16 East Fortieth Street, New York, N. Y., for $8,448; fixtures for the office building, main stairs, the entrance hall and Mayor's suite, to the Mitchell Vance Co., 836 Broadway, New York, N. Y., for $3,600. The commission has decided to ask for further designs for the principal exterior fixtures to be located on each side of the steps.

BIG RAPIDS, MICH.—Bids will be received until Nov. 29 for the erection of the substructure of a power plant for the municipal water-works. Gardner S. Williams, of Ann Arbor, is consulting engineer. H. J. Ward is president of board of public works.

KALAMAZOO, MICH.—Bids will be received by the city of Kalamazoo until Nov. 25 for equipment for the proposed new municipal electric-light plant. Bonds to the amount of $115,000 have been authorized for the plant. Woodmansee, Davidson & Sessions, 38 South Dearborn Street, Chicago, Ill., are consulting and supervising engineers. C. L. Miller is city clerk.

MILLINGTON, MICH.—Oliver B. Whipple, owner of the local electric-light plant, is securing estimates on cost of new power equipment for his plant. Steam, gas and oil apparatus are being considered, and complete new equipment will probably be installed next spring.

BROWNTON, MINN.—The village has voted to issue $2,500 additional bonds to complete the municipal electric-light plant and village hall.

DULUTH, MINN.—Arrangements are being made for the installation of an ornamental street-lighting system on West Superior Street next spring by the West End Commercial Club. The plans provide for the installation of 10 ornamental lamp standards to each block between Eighteenth and Twenty-second Avenues. A. B. Anderson is chairman of the committee.

EDEN VALLEY, MINN.—The Lethert Co. has commenced work on the construction of its power station. It is expected to have the electric-light plant completed in April, 1913.

HIBBING, MINN.—The Hibbing Water and Light Commission, it is reported, has acquired the distributing system of the Brooklyn electric plant from A. P. Silliman for $17,795. Brooklyn is within the limits of the village of Hibbing, and Mr. Silliman has been furnishing electrical service to that suburb, power for which has been secured from the Hibbing plant.

MONTICELLO, MINN.—Arrangements are being made to organize a company under the name of the Monticello El. Lt. & Pwr. Co. to install an electric-light plant here. The Village Council has passed an ordinance granting the company a 25-year franchise to build and operate an electric plant and a five-year contract for street lighting. The contract provides for 12 lamp standards each carrying a three-lamp cluster, one 100-watt tungsten lamp, one 75-watt tungsten lamp and 28 overhead lamps, for $1,000 per year. J. T. Hatman, F. O. Godfrey and E. M. Ruede, of Kansas City, are interested in the company. Work is to begin on the plant within 30 days.

VIRGINIA, MINN.—The Virginia El. Pwr. & Wtr. Co. has accepted the proposition of the city of Virginia to purchase the property for a consideration of $493,000 and special allowance for recent improvements, which will amount to an additional $50,000. A special election will be held to vote on a bond issue to pay for the plant.

BUTTE, MONT.—Announcement has been made that the Butte El. & Pwr. Co. and its affiliated corporations owning reservoirs and operating plants on the Jefferson, Madison, Missouri and Yellowstone Rivers are to be consolidated under the name of the Montana Pwr. Co. The new company will be controlled by the same interests as the Butte El. & Pwr. Co. It is stated that the Montana Pwr. Co. contemplates an early expenditure of from $12,000,000 to $15,000,000. C. W. Wetmore, of New York, N. Y., will be president and Max Hebgen, of Butte, vice-president and general manager.

KEARNEY, NEB.—The City Council has formulated petitions for circulation calling a special election to vote on the proposition to install a municipal electric-light plant to supply electricity for lighting the streets and for commercial purposes. The Council proposes to fight an injunction suit against an issue of $40,000 now in the courts and add the new bonds if the proposition is carried.

GOLDFIELD, NEV.—The Goldfield Ore Mining Co. will install electrically operated apparatus, including hoist, compressor, sinking pump and miscellaneous machinery.

TONOPAH, NEV.—The substation of the Nevada-California Pwr. Co. at Tonopah was destroyed by fire recently, causing a loss of about $50,000. A new station will be erected immediately.

SOUTH ORANGE, N. J.—Sealed proposals will be received by the water committee of the Village Board of Trustees of South Orange until Nov. 25 for electric wiring and steel smoke connections. Plans and specifications may be obtained by applying to John J. Boyd, consulting engineer, 11 Broadway, New York, N. Y. M. A. Fitzsimmons is city clerk.

BROOKLYN, N. Y.—Sealed bids will be received until Dec. 2 by Henry S. Thompson, commissioner of the department of water supply, gas and electricity, 13 to 21 Park Row, New York, for furnishing, installing, maintaining and reserving for use of the high-pressure fire service all apparatus and equipment necessary for generating and transmitting 1830 kw of three-phase, 6600-volt, 25-cycle electric power and furnishing and delivering this power under terms of this contract from Jan. 1, 1913, to Dec. 31, 1913, both inclusive, at each of the high-pressure fire-service pumping stations located in the borough of Brooklyn, at Furman and Joralemon Streets and at Willoughby and St. Edward's Streets respectively. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building.

CHARLOTTE, N. Y.—At a special election held Nov. 11 the proposition to grant the Rochester Ry. & Lt. Co. a franchise to supply electricity and gas in Charlotte was carried. The second proposition to sell the company the distributing system, transformers and other equipment, outside of the electric plant, for $4,500 was also carried. The village has operated a municipal plant for ten years which has proved a failure.

DOLGEVILLE, N. Y.—The Village Board has authorized a change in the street-lighting system from incandescent cluster lamps to 100-watt tungsten lamps. Four arc lamps were also authorized to be installed on Main Street. The change will be made at the expense of the Utica Gas & El. Co., of Utica, which holds the street-lighting contract.

LYONS, N. Y.—A deal has been closed whereby the Niagara, Lockport & Ontario Pwr. Co., of Buffalo, has purchased the steam generating plant of the Rochester, Syracuse & Eastern R. R. Co. in Lyons and the generating station of the Auburn & Syracuse El. R. R. Co. at Auburn. The price paid for the Lyons plant was $600,000 and that for the Auburn plant $226,000. The plants will be taken over by the Niagara, Lockport

& Ontario Co. on Dec. 1. Contracts have been executed between the Niagara, Lockport & Ontario Pwr. Co. and the Beebe electric railway system whereby the former will furnish power for all the railways of the Beebe system, except the Buffalo, Lockport & Rochester and the Newark and Marion railroads, which already have a contract with the power company, for a period of 20 years. Both the Lyons and Auburn plants will be operated until the Salmon River hydroelectric plant is completed.

NEW YORK, N. Y.—The J. G. White & Co., Inc., is to divide into two companies, one to be known as the J. G. White Engineering Corpn., to look after all the engineering and construction work, and the other, under the name of the J. G. White Management Corpn., to take over the organization work of the present company. The new engineering company will be capitalized at $2,000,000. The capital stock of the management company will be placed at $1,000,000.

NEW YORK, N. Y.—Sealed bids will be received until Dec. 2 by Henry S. Thompson, commissioner of water supply, gas and electricity, Room 1904, 13 to 21 Park Row, New York, for furnishing, installing, maintaining and preserving for the use of the high-pressure fire service all apparatus and equipment necessary for generating and transmitting 3250 kw of three-phase, 6600-volt, 25-cycle electric power and furnishing and delivering this power under the terms of this contract from Jan. 1, 1913, to Dec. 31, 1913, both inclusive, at each of the high-pressure fire-service pumping stations located in the borough of Manhattan, at Oliver and South Streets and at Gansevoort and West Streets respectively. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building.

ORWELL, N. Y.—The Salmon River Pwr. Co., which is controlled by the Niagara, Lockport & Ontario Pwr. Co., Buffalo, has filed ten petitions with the Public Service Commission, Second District. Three of these ask for authority to acquire and exercise franchises which the Pulaski El. Lt. Co., of Pulaski, holds for electrical distribution in the towns of Richland, Orwell and Albion. This company also asks for approval of franchises for distributing electricity in the towns of Parish and Hastings and villages of Altmar and Central Square, Oswego County, and towns of Cicero, Clay and Salina, Onondaga County. The Salmon River company, it is stated, is now constructing a hydroelectric plant on Salmon River in the town of Orwell, with transmission lines from its power house to the village of Solvay, where they will connect with the transmission lines of the Niagara, Lockport & Ontario Pwr. Co. This company is the successor of the Oswego County Lt. & Pwr. Co. and some of the franchises sought to be exercised were issued to its predecessor.

OXFORD, N. Y.—Proposals will be received by Mrs. Georgiana Griffith, president of the board of managers of the New York State Woman's Relief Corps Home, Oxford, until Dec. 2, for installing one 35-kw direct-current dynamo and engine, directly connected, at the home. Drawings and specifications may be consulted and blank form of proposal obtained at the New York State Woman's Relief Corps Home, Oxford, and at the office of Herman W. Hoefer, Capitol, Albany.

YONKERS, N. Y.—The contract for furnishing lamp standards for the ornamental street-lighting system in the business section of the city has been awarded to the Morris Iron Co. The plans provide for 150 standards.

FARGO, N. D.—Bids will be received by A. R. Watkins, city auditor, until Nov. 25, for the installation of a cluster-lamp system in the White Way district No. 1 and also for district No. 2.

LA MOURE, N. D.—The Council has rejected the proposition submitted by S. C. Page, of Sherburne, Minn., to install an electric plant here.

BROADWELL, OHIO.—The power plant of the Big Four Coal Mine at Broadwell was recently destroyed by fire, causing a loss of about $2,000. The equipment, including dynamo, engine and hoisting machinery, was entirely destroyed.

CLEVELAND, OHIO.—The contract for six water-tube boilers for the municipal electric-light plant has been awarded to the Babcock & Wilcox Co., Cleveland, for $104,683.

COLUMBUS, OHIO.—Superintendent H. E. Eichhorn of the municipal electric-light plant has estimated the total cost of installing the cluster lamp system for street-lighting as recommended recently by the gas and electricity committee of the Council to be about $83,000.

NEW KNOXVILLE, OHIO.—The New Knoxville El. Co. has been granted permission by the Public Service Commission to issue $8,000 in capital stock, the proceeds to be used for the purchase of equipment and apparatus for the erection of an electric transmission line from Moulton to New Knoxville, Ohio, and for the erection of an electric light and power distributing system in New Knoxville.

TOLEDO, OHIO.—Sealed proposals will be received at the office of J. R. Cowell, director of public service, Toledo, until Nov. 27, to furnish and erect an electrically operated traveling crane of 25 tons' capacity with a span of 63 ft. from center to center of crane rail in the high-service pumping station. Copies of specifications, proposal forms, etc., may be seen at the office of the chief engineer of the Department of Public Service, Valentine Building, Toledo.

WELLSVILLE, OHIO.—At an election held recently the proposition to issue $60,000 in bonds for the construction of a municipal electric-light plant was carried.

HINTON, OKLA.—Bonds to the amount of $30,000 have been voted for the installation of a municipal electric-light plant and water-works system in Hinton. The Benham Engineering Co., American National Bank Building, Oklahoma City, has charge of the engineering work.

ALBANY, ORE.—Preparations are being made by the Corvallis & Eastern R. R. Co. to equip its railroad between Albany and Corvallis, a distance of about 10 miles, for electrical operation.

PORTLAND, ORE.—The Pacific Tel. & Teleg. Co. has been granted a permit by the city authorities to construct a 14-story office and plant building, at Park and Oak Streets.

SALEM, ORE.—An electric line is to be built from the Lake Labish district to connect with the Oregon El. Ry. and the Southern Pacific Railroad, work on which will begin in the spring.

THE DALLES, ORE.—The Grandalles Orchard Tracts Co. has entered into a contract with the Pacific Pwr. & Lt. Co., of The Dalles, whereby the latter will erect a transmission line across the Columbia River to Crates Point to supply electricity to operate the irrigating pumps.

ALLENTOWN, PA.—The Citizens' El. Lt., Ht. & Pwr. Co. has increased its capital stock from $40,000 to $250,000.

ALLENTOWN, PA.—Notice of increase of capital stock from $5,000 to $50,000 has been filed with the Secretary of State by the Salisbury, Emaus and Hanover El. Lt. & Pwr. Cos., all of Allentown.

ALTOONA, PA.—Another large department unit is to be added to the Pennsylvania Railroad's plant in this city. A new engine house is to be erected, and machine and blacksmith shops will be built equipped with an electric traveling crane. A mechanically operated coaling station will be installed, two 50,000-gal. tubs will supply water, and a power plant will supply electricity for lamps and motors and operate air compressors and pumps. G. W. Creighton, of Altoona, is general superintendent.

APOLLO, PA.—The West Penn Trac. & Wtr. Co., Pittsburgh, has recently closed a contract with the Apollo Steel Co., of Apollo, to furnish electricity to operate its large mills here. The first motor instalment, consisting of a 1500-hp General Electric alternating-current motor, is now under way. The West Penn Trac. & Wtr. Co. is already furnishing either partial or entire equipment for a number of steel mills similar to the Apollo mills in the Pittsburgh district, and negotiations are under way with several more plants.

ASPINWALL, PA.—Sealed proposals will be received by the borough of Aspinwall until Nov. 25 for furnishing said borough with electric current delivered at switchboard in borough pumping station. S. R. Chase is borough clerk.

GOLDSBORO (ETTERS P. O.), PA.—At the election held Nov. 5 the proposition to appropriate $3,000 for the purpose of securing electricity for the borough was carried. The Council will proceed at once to make arrangements to secure electrical energy. It is proposed to furnish electricity to private consumers as well as to light the streets and public places.

NEW WILMINGTON, PA.—At the election held recently the proposition to issue $3,000 in bonds to purchase additional machinery for the municipal electric-light plant was carried.

PHILADELPHIA, PA.—The Counties Gas & El. Co. has filed notice of increase of capital stock from $2,000,000 to $7,500,000.

PITTSBURGH, PA.—The merger of the Ohio Valley El. Co. into the Southern Ht., Lt. & Pwr. Co. has been approved by Governor Tener. The company is capitalized at $300,000. J. D. Calley, of Pittsburgh, is president.

CAMDEN, S. C.—Sealed proposals will be received by the Commissioners of Public Works until Dec. 19 for construction of an electric-light plant and water-works system. The work will consist of auxiliary and main pumping station, steam and electrically operated pumps, 300-hp boiler plant, 1,000,000-gal. filter plant, reservoir, generator, complete lighting system and about 3 miles of 10-in. and 12-in. pipe line. Plans and specifications are on file at the office of J. J. Goodale, secretary, Camden, and at the office of Gilbert C. White, Charlotte, N. C., engineer. Specifications, bidding sheets, etc., can be secured by application to the engineer. A complete set of plans will be mailed on payment of $5 to cover cost.

KINGSTREE, S. C.—The Kingstree El. Lt. & Ice Co. is planning to erect a power plant and install a 75-kw electric generating unit and a 15-ton ice plant. P. G. Gourdin is president of the company.

DIMOCK, S. D.—We are informed that the installation of an electric-lighting system in Dimock is not contemplated, as stated in these columns in the issue of Nov. 9.

CHATTANOOGA, TENN.—All bids opened by the committee of the Chattanooga Merchants' Association on Nov. 7 for ornamental street lamps were rejected. New specifications will be prepared and new bids asked for. O. K. Le Bron is chairman of committee.

CLINTON, TENN.—The engine house of the Clinton El. Lt. & Pwr. Co. was destroyed by fire recently, causing a loss of about $5,000. The engine and dynamos are a total wreck. W. E. Hemphill is interested in the company.

DUFFAU (R. F. D., HICO), TEX.—The Duffau Mineral Wells Co. is interested in a project to install an electric-light plant. T. W. Elkins is president.

JACKSBORO, TEX.—The local electric-light plant, owned by Hensley Brothers, has been acquired by the Jacksboro Lt. & Ice Co., recently organized by J. G. Brown, of Gibtown, and others. The new owners will install new machinery.

SIDE GUIDE AND GRIP

NACOGDOCHES, TEX.—The Scott Engineering Co., of Dallas, Tex., has been engaged to prepare plans for an electric-light plant, to cost about $20,000. It is understood that the city will soon ask for bids for construction of the plant. J. R. McKennan is secretary.

PLAINVIEW, TEX.—The Malone Lt. & Ice. Co. has executed a deed of trust to the Commonwealth Trust Co., of St. Louis, Mo., to secure $60,000 in bonds. The proceeds will be used for extensions and improvements to its plant.

WICHITA FALLS, TEX.—Bonds to the amount of $10,000 have been voted for the installation of an ornamental street-lighting system. The plans provide for 200 lamp standards carrying cluster lamps, maintained by underground wires. L. C. Hinckley is city engineer.

BERKLEY SPRINGS, VA.—The Great Cacapon Fruit Farm & Development Co., recently incorporated with a capital stock of $100,000 for the purpose of operating in the Cacapon district in Morgan County, proposes to deal in real estate, generate and distribute electricity, build and operate a hotel and deal in wood products. J. F. W. Crontmeyer, of McKeesport, Pa.; A. L. Wilson and G. W. Newell, of Berkley Springs, and E. L. Crontmeyer, of Weirton, W. Va., are incorporators.

RICHMOND, VA.—The Monroe Terrace Corpn., 412 Mutual Bldg., Richmond, will purchase equipment for power plant, including boilers, engines, pumps and a quantity of electrical apparatus.

BREMERTON, WASH.—The Olympic Pwr. Co. has awarded the contract for the construction of a concrete power house on Pacific Avenue to Joseph Stangler & Co., of Bremerton.

BREMERTON, WASH.—The City Council has decided to establish a municipal lighting plant and will either purchase the plant of the Bremerton-Charleston Lt. & Fuel Co. or install a new plant.

TACOMA, WASH.—P. H. Hebb, owner of a power site on the White River, has submitted a proposition to the city of Tacoma offering to sell the city the first 15,000 hp from his new plant at the rate of $20 per hp per year. Mr. Hebb expects to have the plant in operation in about 18 months.

NEENAH, WIS.—The Mayor has appointed a committee to secure estimates of the cost of erecting power house and installing equipment for a municipal electric-light plant here.

SPRING VALLEY, WIS.—The property of the Spring Valley Lt. & Pwr. Co. has been purchased by the Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, which, it is said, will make a number of improvements. The Chippewa company, it is understood, will build a new dam here, to be 7 ft. higher than the present dam.

WORLAND, WYO.—The Wyoming El. Devel. Co., which was recently granted a franchise here, will install an electric-light plant and also an ice factory.

VANCOUVER, B. C., CAN.—The British Codlumbia El. Ry. Co. is planning to double the output of its power plant on Jordan River, at a cost of about $1,500,000. The generating capacity of the plant is now 12,000 hp.

HANLEY, MAN., CAN.—The contract for the installation of the municipal electric-light system complete has been awarded to the British-Canadian Engineering & Supply Co., of Winnipeg. A. Holm is city secretary and treasurer.

WINNIPEG, MAN., CAN.—Sealed tenders will be received by the chairman of the board of control until Nov. 29 for furnishing and installing turbine pumps and motors required for the extension of the artesian well-water-supply system of the city of Winnipeg. Specifications and form of tender, together with conditions governing tenders, may be obtained at the office of the city engineer, 223 James Avenue. M. Petersen is secretary of the board of control.

GEORGETOWN, ONT., CAN.—At the election held Nov. 11 the ratepayers voted in favor of the by-law to contract with the Hydro-Electric Commission for hydroelectric power.

GUELPH, ONT., CAN.—The Light and Heat Commission has decided to supply electricity to the Dominion Linen Mills and other factories outside of the city limits at the same price as is charged to the citizens of Guelph, with the exception that the companies will supply their own motors. The commission has also made an offer to supply electricity in Wellington Place, a new residential suburb, provided that the residents and the Guelph Country Club will erect the transmission line from the present terminus, near the city limits, to the suburb.

HAGERSVILLE, ONT., CAN.—The Council has passed a by-law authorizing the reeve and clerk to sign a contract with the Hydro-Electric Commission for electricity to the amount of 150 hp. An effort will be made to have the plant installed before the new year.

HAMILTON, ONT., CAN.—The Hydro-Electric Power Commission has issued an order requiring all wires to be placed underground in the downtown district of this city. This order will affect the Cataract Pwr. Co. and the Hamilton Hydro-Electric service. Provision is also to be made for telephone and telegraph wires. The conduit will be built by the city of Hamilton.

LONDON, ONT., CAN.—The London St. Ry. Co. has rejected the proposition to operate its system by power from the Hydro-Electric Commission and will increase the output of its steam generating plant, at a cost of about $10,000. The company is now installing an additional engine.

NIAGARA FALLS, ONT., CAN.—The Ontario Pwr. Co. is planning to install two 12,000-hp units at its plant in Niagara Falls.

PARIS, ONT., CAN.—The City Council has entered into a contract with the Hydro-Electric Power Commission for hydroelectric power to the amount of 600 hp, at the rate of $21 per hp. The contract for the erection of a substation between Paris and Brantford has been awarded. Paris will not be connected with the Hydro-Electric system until next summer.

WELLAND, ONT., CAN.—Arrangements are being made for the installation of a municipal electric-light system, for which $45,000 was voted some time ago. Power for operating the system will be purchased.

MONTREAL, QUE., CAN.—The National Hydro-Electric Co., which has petitioned the Legislature for authority to do business in Montreal and vicinity, has acquired a water-power at Carillon Falls which, it is estimated, will develop about 160,000 hp. The cost of the development is estimated at about $10,000,000.

MONTREAL, QUE., CAN.—The Saraguay El. & Wtr. Co. has applied to the Quebec Legislature for authority to change its name to the Light & Power Co. of Montreal and to increase its capital stock to $45,000,000. The company also asks for authority to ratify the agreements, contracts and arrangements with the Dominion Lt., Ht. & Pwr. Co., the St. Paul El. Lt. & Pwr. Co., the Canadian Lt. & Pwr. Co. and the Central Lt., Ht. & Pwr. Co. Nothing definite will be done toward reorganizing the Saraguay company until the first of the year. H. R. Mallison is general manager.

New Industrial Companies

THE AMERICAN TELEPHONE FIRE ALARM COMPANY, of Rochester, N. Y., has been incorporated with a capital stock of $5,000,000 by David G. Dee, of Rochester; William S. Haring and Fred H. Smith, of Chicago, Ill. The company proposes to manufacture all kinds of fire-alarm, telephone and telegraph apparatus, fire-detection and fire-extinguishing apparatus and to install fire-alarm, burglar and watch-service systems.

THE ANDERSON ELECTRIC CAR COMPANY, of Boston, Mass., has been incorporated with a capital stock of $10,000 by Albert Weatherby, Frank R. Keith and others.

THE COHN & ROTH ELECTRIC COMPANY, of Hartford, Conn., has been chartered with a capital stock of $10,000 for the purpose of manufacturing all kinds of gas and electrical supplies. The incorporators are: A. Cohn, J. Fred Roth and William L. Meyer.

THE GENERAL VEHICLE COMPANY, INC., of Rotterdam, N. Y., has been incorporated with a capital stock of $10,000,000 by J. F. Zoller, S. L. Whitestone and A. M. Jackson, of Schenectady, N. Y., and J. P. Eaton, of Albany. The company proposes to do a general mechanical and electrical engineering business and to deal in mechanical and electrical appliances.

THE HALE-CHRISTY COMPANY, of Cleveland, Ohio, has been incorporated with a capital stock of $3,000 to manufacture and deal in electrical and mechanical devices. W. B. Hale is interested.

NIMIS & NIMIS, INC., of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture machinery, dynamos and electrical and mechanical appliances. The incorporators are: Albert A. Nimis, Joseph P. Smith and Wendell P. Barker, 839 West End Avenue, New York.

THE TWENTIETH CENTURY LIGHT & POWER COMPANY, of Springfield, Ill., has been incorporated with a capital stock of $4,900 by A. B. Simonson, H. C. Kinkhead and A. Mottar. The company proposes to manufacture and install electric light and power plants.

THE WEGNER CONTROL SYSTEM, INC., of Kittery, Maine, has been incorporated with a capital stock of $1,000,000 to manufacture and deal in electrical devices. A. H. Wegner is president and S. P. Harmon treasurer, both of Portsmouth, N. H.

THE WIRELESS ELECTRIC LAMP COMPANY, of Elizabeth, N. J., has been incorporated by James C. Sharpe, Frederick P. Hall and Charles A. Trimble. The company is capitalized at $50,000 and proposes to manufacture electric signs.

New Incorporations

MARIANNA, ARK.—The Marianna El. Lt. Co. has been incorporated with a capital stock of $35,000 to supply electricity in Marianna. The officers are: E. C. Horner, president, and A. P. Horner, secretary and treasurer, both of Helena.

LIVINGSTON, ILL.—Articles of incorporation have been filed for the Twin City Lt., Ht. & Pwr. Co. with a capital stock of $2,500 to furnish light, heat and power. The incorporators are: D. E. Aylward, Samuel M. Westwood and J. D. Mullen.

NOBLESVILLE, IND.—The Indiana Gas Lt. Co. has been incorporated with a capital stock of $1,000,000 for the purpose of generating and distributing gas and electricity in Hamilton, Tipton and Hancock. The company will also supply natural gas. The company will acquire the gas plants in Noblesville and Tipton and erect a large gas plant in Tipton. The directors are: Paul E. Neuffer, H. A. Phillips and Charles J. Horn, all of Chicago, Ill.

SIDE GUIDE AND GRIP

BOSTON, MASS.—The Andrew G. Paul Co. has been incorporated with a capital stock of $300,000 to build and operate power systems and plants. The directors are: H. W. Sprague, president; Van Courtland Lawrence, 649 Tremont Building, Boston, treasurer, and D. E. Manning.

FITCHBURG, MASS.—The Fitchburg Phoenix Ltg. Co. has been incorporated with a capital stock of $1,000 by Robert M. Sherman, Maud V. Sherman and Frederick H. Lane.

CHISHOLM, MINN.—The Chisholm El. Co. has been incorporated with a capital stock of $100,000 by William A. Koon, of Minneapolis; Clark Hempstead and John H. Ray, Jr., of Chicago, Ill. The company will take over the property of the Range Pwr. Co. Improvements and extensions will be made to the system.

WESTFIELD, N. J.—The North Jersey El. Co. has filed articles of incorporation with a capital stock of $10,000, for the purpose of constructing dams in rivers and streams of New Jersey for the purpose of generating electricity. The incorporators are: Richard Bennett, Jr., of Brooklyn; William Hayward, of New York, and Fred E. Sturgis, of Westfield.

NEW YORK, N. Y.—The Wisconsin Edison Co. has been incorporated with a capital stock of $12,000,000 by Henry H. Pierce, Frederick H. P. Fiske, James D. Mortimer, Edward H. Green, John Foster Dulles and Thomas H. Ryan, of New York. The company will take over the holdings of the North American Co. and the public utilities which it controls within the State of Wisconsin. It will own the capital stock of the Milwaukee Lt., Ht. & Trac. Co., which in turn owns the Milwaukee El. Ry. & Lt. Co., the Wisconsin Gas & El. Co., the Watertown Gas & El. Co., the North Milwaukee Lt. & Pwr. Co., the Burlington Lt. & Pwr. Co. and the common stock of the Milwaukee El. Ry. & Lt. Co., which was issued for the acquisition of the property of the Milwaukee Central Heating Co.

CLEVELAND, OHIO.—The Continental Gas & El. Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $7,500,000. W. H. Abbott, of the firm of Abbott & Eaton, 1000 Schofield Building, Cleveland, is interested in the company. The headquarters of the company will be located at 1000 Schofield Building, Cleveland.

CLEVELAND, OHIO.—The Metropolitan Tel. & Teleg. Co., of Cleveland, has been incorporated with a capital stock of $10,000 by W. E. Hawley, J. W. Larish, L. B. Stanley, John B. Chapman and N. I. Phelps. This is a subsidiary of the Metropolitan Tel. & Teleg. Co. of New York, which is building a 16-wire line between New York and Chicago. The local company has applied to the City Council for a franchise and has established offices in the New England Building, Cleveland. W. E. Hawley and W. G. Cline are in charge.

CROWDER, OKLA.—The Guardian Ltg. & Industrial Co. has been incorporated with a capital stock of $15,000 by A. E. Barrow, H. E. Rowton and E. G. Narrow.

TULSA, OKLA.—The Consol. El. Co. has been incorporated to build an interurban railway from Tulsa to Sapulpa, a distance of 15 miles. The company will also take over the system of the Union Trac. Co. in Tulsa.

ST. HELEN, ORE.—Articles of incorporation have been filed for the St. Helen Lt. & Pwr. Co. with a capital stock of $50,000 by E. H. Meyers, C. R. and H. F. McCormick.

BLOOMSBURG, PA.—The Columbia & Montour El. Co. has been granted a charter with a capital stock of $5,000 to furnish electricity for lamps and motors here. E. R. Sponsler, of Harrisburg, is one of the incorporators.

HARRISBURG, PA.—Charters have been granted by the State Department to the Marietta, Conestoga, Elizabethtown, Martic Township, Pequea, Providence Township and Strasburg Electric Companies, of Lancaster County. Each company is capitalized at $5,000 and will do business in the locality for which it is named. Congressman W. W. Greist is the principal stockholder.

PHILADELPHIA, PA.—The Upper Providence El. Lt. Co. has been granted a charter with a capital stock of $5,000. T. W. Morris, 38 Summit Street, Philadelphia, is interested in the company.

PINE GROVE, PA.—The Pine Grove El. Lt., Ht. & Pwr. Co. has been granted a charter with a capital stock of $15,000. Preparations will be made to begin work at once on construction of an electric plant here. The incorporators are: E. J. Thomas, Wallace Drumheller and H. L. Troxell.

STOYESTOWN, PA.—Charters have been granted to the Jenners El. Lt., Ht. & Pwr. Co. to operate in Jenners Township, and the Listie El. Lt., Ht. & Pwr. Co. to operate in Listie Township. Both companies are capitalized at $10,000 and the incorporators are: G. J. Long, A. J. Weimer and G. A. Noon, of Freidens. The offices of the company are located in Stoyestown.

EAGLE PASS, TEX.—Articles of incorporation have been filed by the International El. Co. with a capital stock of $160,000 by W. H. Painter, Charles H. Hubbell, D. G. Fisher and others. The company proposes to generate and distribute gas and electricity for lamps, heat and motors.

RIVIERA, TEX.—The Riviera Beach & Western R. R. Co. has been organized to construct an interurban railway between Riviera Beach and Falfurrias via Riviera, a distance of 35 miles. The portion between here and Riviera Beach, 10 miles, is nearly finished and will soon be placed in operation. The company is capitalized at $35,000. The incorporators are: Theodore F. Koch, Carl C. Henry, Samuel Lilligren, of Houston; Richard M. Kleberg, of Kingsville, and Marcos Phillips, of Riviera.

TEXAS CITY, TEX.—The Texas City St. Ry. Co. has been organized with a capital stock of $60,000 to construct an electric interurban railway between Texas City and Texas City Junction. It will also build a street railway system in Texas City. The incorporators are: H. B. Moore, J. R. Goodson and F. N. Danforth, all of Texas City.

MONTPELIER, VT.—The Montpelier & Barre Lt. & Pwr. Co. has been incorporated under the laws of Massachusetts with a capital stock of $2,100,000 by Albert B. Tenney, A. E. Bradley, H. A. Gidney and D. W. Leavitt. It is understood that the company will take over the Vermont Pwr. & Lt. Co. and the Consolidated Ltg. Co., Torry, Deavitt & Frost, and the Barre & Montpelier Trac. Co., all of Montpelier.

SEATTLE, WASH.—The Pacific Coast Lt., Pwr. & Ry. Co. has been incorporated with a capital stock of $500,000, by Albert M., I. N. and K. E. Robinson, D. L. Chipman and F. E. Brightman.

MARTINSBURG, W. VA.—The Hedgesville Lt. & Ht. Co. has been incorporated with a capital stock of $1,000 by W. E. Gordon, R. C. Miller, J. E. Wyndham and others.

Trade Publications

ELECTRIC SIGNS.—Bulletin No. 167 of the Federal Sign System (Electric), Chicago, Ill., is devoted to its miniature-lamp-letter electric signals and fixtures and frames for alphabet-lamp-letter electric signs.

MOTOR-GENERATOR SETS.—The Crocker-Wheeler Company, Ampere, N. J., has issued recently Bulletin No. 156, which takes the place of No. 116, previously published. It describes and fully illustrates motor-generator sets for all purposes.

BALL BEARINGS.—The Hess-Bright Manufacturing Company, Philadelphia, Pa., is sending out some further additions to its loose-leaf literature referring to ball bearings. A numerical and a classified index to data sheets previously issued are included with this latest matter.

THE KEOKUK PROJECT.—The Stone & Webster Engineering Corporation, of Boston, has recently issued a sixteen-page booklet on the St. Louis-Keokuk transmission line, which tells briefly the story of this interesting and important installation. Some miniature illustrations brighten the text, and a map is also shown.

CORD ADJUSTER.—An eight-page leaflet is being distributed by the Sachs Laboratories, Inc., 103 Allyn Street, Hartford, Conn., referring to the Sachs magna adjuster. Descriptive matter and an illustration of the adjuster in use, a diagram, showing its operation and a cut of the parts unassembled make up the contents.

TROLLEY WIRE.—The Bridgeport Brass Company, Bridgeport, Conn., is sending out a cardboard folder asking the recipients to make a test of "Phono-Electric" wire where there has been trouble, and to watch the results and make comparisons, by which they will learn why "Phono-Electric" is a most economical wire to use.

HIGH-VOLTAGE FUSES.—The Delta-Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill., is distributing a very complete bulletin on S. & C. fuses and weatherproof mountings for use on all potentials up to and including 66,000 volts. In it special attention is called to the type of fuse mounting used in protecting outdoor substations.

INSULATED WIRE.—The New York Insulated Wire Company, 114 Liberty Street, New York, is sending out practical reminders of the merits of its products in the form of blotters. One blotter contains a little talk on Grimshaw and Competition tapes and a calendar for November in the lower corner, and the other blotter refers to its wires, Raven Core and Grimshaw.

SECOND-HAND MACHINERY.—A catalog of electrical and steam machinery, cars, car equipments, etc.—used machinery—has just been issued by MacGovern & Company, Inc., 114 Liberty Street, New York. This machinery, while it has been in service, is available because of changes in type or capacity that have rendered it expedient to install other apparatus in its place.

RAILWAY TYPE FANS.—A four-page circular is being sent out by the Diehl Manufacturing Company, Elizabethport, N. J., referring to its railway-type fans. The company states in this bulletin (No. 504) that these fans are the result of a gradual development to meet the conditions of change in construction, style and general service of the railroad car now demanded by the traveling public.

REFLECTORS.—Veluria reflectors of the commercial type are made the subject of a recently published booklet printed by the Holophane Works of the General Electric Company. Veluria is a thin, opal glass, with a small percentage of absorption, and is designed to distribute the light rays in the proper directions. They are especially recommended by the makers where a soft, mellow light is desired.

LOCOMOTIVE CRANES.—Supplement 5 of the Browning Engineering Company, Cleveland, Ohio, is a large, four-page leaflet, containing six photographs of actual installations of the Brown locomotive crane in various industries. One of the photographs shows the Browning electric locomotive crane and clamshell bucket in use at the plant of the Merchants' Heat & Light Company of Indianapolis.

PHOTOMETERS.—The Reichsanstalt precision photometer and accessories form the text for a catalog (No. 60) which bears the imprint of the Leeds & Northrup Company, manufacturer of electrical measuring instruments, 4901 Stenton Avenue, Philadelphia, Pa. The apparatus described in this publication is the result of a thorough reconsideration of every detail of the company's photometric instruments.

CLEANSER FOR ELECTRIC GLASSWARE.—The Myrlite Company of America, Pownal, Vt., has issued a bulletin relating to its cleansing material for globes, bulbs and reflectors. The merits of the cleanser are outlined in the bulletin, which also contains numerous testimonials from central-station companies and manufacturers. Curves showing the loss in luminous efficiency due to dirty glassware and lamps form part of the bulletin.

STORAGE BATTERIES.—"Some Recent Developments in the Lead Battery for Electric Vehicles" is the subject of a four-page folder—Bulletin No. 137—recently issued by the Electric Storage Battery Company, Philadelphia, Pa. It is a reprint of a paper read by Mr. Bruce Ford at the third annual convention of the Electric Vehicle Association of America held in Boston last month. A number of small illustrations accompany the text.

CHANGE IN LAMP PRICES.—The Eastern Electric Company, 141 Milk Street, Boston, Mass., is making announcement of the reduction in price of "Eastern" drawn-wire tungsten-filament lamps which became effective Oct. 1. The company is also sending out periodically small blotters, on one side of which is a little talk on "Eastern" incandescent lamps, and some cards of small envelope size containing the monthly calendar.

POLES AND TIES.—The Naugle Pole & Tie Company, 5 South Wabash Avenue, Chicago, Ill., is sending out a folder, 11 in. by 14¾ in. when opened for reading, which gives an illustration of one of its three pole alleys and a short talk on its products. For convenience in writing for estimates on poles two postal cards which form part of the folder may be easily detached and sent to the company, giving the requirements of the prospective purchaser.

INNER GLOBES.—The Holophane Works of the General Electric Company, Cleveland, Ohio, has published a little data book on inner globes, which describes the "Noblac" product. It is stated that the low maintenance cost makes the "Noblac" inner globes most economical in service and economical in the use of carbons, as well as in the longer life of the globes themselves. Central-station men, contractors and supply dealers will find this booklet of interest.

PUMPS.—The Alberger Pump & Condenser Company, 140 Cedar Street, New York, has recently published a twelve-page booklet which deals with Alberger boiler-feed pumps. By brief descriptive matter it is aimed to show why leading engineers install turbine boiler-feed pumps in modern power stations in preference to reciprocating pumps. There are a number of illustrations, a diagram of an outline elevation of the Alberger pump and a table of approximate dimensions.

CURRENT-LIMITING REACTANCES.—Bulletin No. 4974, issued by the General Electric Company, illustrates and describes in considerable detail a device known as a current-limiting reactance, for the protection of apparatus from mechanical stress due to heavy current overloads. It is designed to be placed in series with generators or transformers and to limit the flow of current under short-circuit conditions to values which can be safely withstood by both the generator and transformer.

GEARS.—The Earle Gear & Machine Company, Stenton & Wyoming Avenues, Philadelphia, Pa., has recently distributed an illustrated twelve-page pamphlet referring to herringbone gears. It contains information as to the relative values of the "herringbone" gears as compared with the ordinary spur gearing. It is claimed for the former that by their use it is possible to deliver greater power with minimum friction and noise and that they are particularly adapted to high speeds.

VARIABLE-SPEED ENGINES.—The American Engine Company, Bound Brook, N. J., in a twelve-page booklet prints an imposing list of users of its variable-speed engines in the paper-mill industry, indicating the equipment installed in each instance. These variable-speed paper-mill engines cover a range of eight to one and may be directly connected to paper machines, eliminating all intermediate gearing. The highest efficiency and reliability are also claimed for the constant-speed type.

INDUCTION MOTORS.—Bulletin No. 155, recently issued by the Crocker-Wheeler Company, Ampere, N. J., which supersedes Bulletin No. 146, refers to form "Q" induction motors for operating on 60-cycle polyphase alternating-current circuits. This form of motor can be applied to a wide range of machines and industries, and where alternating current is available may be employed to drive every kind of machinery from blowers to boring mills and from sewing machines to steel mills.

PORCELAIN INSULATORS.—The Insulator Book for 1912, issued by the Locke Insulator Manufacturing Company, Victor, N. Y., gives considerable practical data relating to pole and tower line construction, wire, line protective devices, etc., which appear under the simple title of "Notes." The illustrations of representative types of modern towers and line construction lend additional interest. The catalog contains, as well, illustrations and specifications of the company's products. It is 9 in. wide by 6 in. long and is arranged in loose-leaf form.

HIGH-TENSION AIR SWITCHES AND FUSES.—The Railway & Industrial Engineering Company, 702 People's Bank Building, Pittsburgh, Pa., in its September bulletin, No. 8, illustrates and describes the construction, operation and erection of its Burke high-voltage airbreak switches, improved horn-type lightning arresters and fuses. Outdoor substations and portable substations are also considered. A diagram showing a switch mounting for 15,000 volts, 300 amp, is given, and also a list of some of the users of this company's apparatus.

MEASURING INSTRUMENTS.—Bulletin No. 11 of the Hoskins Manufacturing Company, 453 Lawton Avenue, Detroit, Mich., deals with its "International" ammeters and voltmeters for alternating-current and direct-current circuits and makes brief references to the Hoskins electric furnaces, thermo-electric pyrometers and electric hot plates. The constructive features of the portable and switchboard meters for alternating currents and direct currents are given, with illustrations showing various types of these instruments and diagrams and specifications of the same.

USES OF STORAGE BATTERIES.—The Electric Storage Battery Company, Philadelphia, Pa., is distributing an eighteen-page booklet dealing with some interesting facts about the various uses of storage batteries. Many persons are not familiar with the numerous uses of storage batteries and the great number of them in operation. This little book will serve to show how widely and diversely storage batteries are used. Fifteen miniature illustrations, accompanied by brief descriptions, showing fifteen purposes for which storage batteries are employed, are presented and serve to increase general knowledge on this important subject.

REFLECTORS.—Catalog No. 17, recently issued by Gillinder & Sons, 135 Oxford Street, Philadelphia, Pa., treats of Melilite reflectors. These reflectors are made of an entirely new material which it is claimed covers many of the defects of numerous glass globes on the market. Melilite possesses a peculiar translucency which produces an attractive effect when lighted within. This catalog illustrates the bowl and flared types and presents charts showing the relative distribution of light cast by a tungsten lamp with and without these types of globes. Melilite balls, ceiling bowls and bowls for indirect lighting are also considered in this publication.

BOILER-TUBE CLEANERS.—The Roto Company, Hartford, Conn., in its Catalog No. 37, which consists of thirty-two pages, tells about its tube cleaners and economy of steam boilers. The rotor appliances made by this company include air-driven, steam-driven and water-driven tube cleaners for cleaning all types of boilers, condensers, heaters, evaporators, etc., with either straight or bent tubes. As the economy, safety and durability of steam boilers depend on keeping the tubes clean and free from boiler scale, the subject of tube cleaners will interest all users of boilers. The catalog is illustrated with half-tones showing the exterior and interior of these rotors and of individual parts.

LAMPS AND ACCESSORIES.—The 1912-1913 catalog of the Deutsche Gasglühlicht Aktiengesellschaft (Auergesellschaft) of Berlin, Germany, has recently been distributed. It is entitled "Armaturen und Installationsmaterial fur Osram-Drahtlampen." Each of the five sections into which it is divided is easily referred to, owing to the thumb-index arrangement. One section is devoted to the construction of the lamp, another to globes, a third to fittings, while another gives illustrations and specifications of various sockets, reflectors and other devices. A subject index in the beginning and a numerical index at the end are also included in this catalog, which has an attractive cover in colors and is well made.

WIRE.—The Standard Underground Cable Company, Ltd., Hamilton, Ont., Can., which was established in order that the rapidly increasing Canadian business of the Standard Underground Cable Company, Pittsburgh, Pa., could be better handled, has issued a neat booklet of sixteen pages which discourses on the cost of poor wire, the safe way to buy wire, the mark of good wire, proof of quality and other "wire" matters, referring specifically to Sterling rubber-insulated wire. Miniature illustrations of buildings in which this wire is used, a view of the Hamilton plant and one of the Perth Amboy plant and a list of "Standard" products make up the contents of this little pamphlet, which is printed in three colors.

PUMPS.—Additions to the trade literature issued periodically by the Deane Steam Pump Company, Holyoke, Mass. (International Steam Pump Company, 115 Broadway, N. Y., successor), include pamphlets on a hydraulic air-charging device, horizontal duplex piston pumps operated by direct-connected vertical gasoline engines, duplex horizontal double-acting power pumps, portable mine pumps, sand riddlers, deep-well pumping machinery, duplex steam pumps, piston pattern; horizontal double-acting single-cylinder power pumps, automatic pumps and receivers, and modern water-works for town and city supply. These publications contain fully illustrated descriptive material and will be of interest to all who have pumping problems to consider.

CENTRIFUGAL PUMPS.—A comprehensive, well-arranged, practical catalog of fifty-six pages, known as Bulletin 627-A, devoted to the Platt centrifugal pumps is being distributed by the Platt Iron Works Company, Dayton, Ohio. It contains just the sort of information that prospective users of centrifugal pumps desire. Illustrated descriptions of various types of Platt pumps, with characteristic curves, are given. A fine illustration of Shore power station of the Cleveland Electric Illuminating Company is included. These pumps have a capacity each of 650 gal. per minute against 300 lb. pressure, at 2100 r.p.m. Various tables on friction loss and fire streams, a table of equivalents of various measures and weights, besides other data, lend additional value to the publication.

ELECTRIC VEHICLES.—The Waverley Company, Indianapolis, Ind., in the publication of its 1912 year book, devoted to "Silent Waverley" electric vehicles, has set a high standard in catalog making. The character of literature that would make a definite appeal to the prospective user, the quality of work that would create the best impression on the future buyer and the kind of publication that the recipient will not lightly

turn aside have evidently been carefully considered. The result is an exceptionally fine piece of work, artistic in coloring, beautiful in make-up and compelling in interest. The outside cover page of gray paper has an opening simulating the upper glass panel of a carriage door, which forms a frame for the heavily embossed photograph on the second inside front cover page, showing the interior of a vehicle with the two seats occupied by women. The top piece that extends across the entire width of each page, depicting the four seasons, is a remarkably fine piece of color work. Four types of vehicles are printed in colors with appropriate seasonal setting in the foreground, also in delicate colors. Each month in the year has its calendar, the zodiacal sign, a list of celebrities' birthdays falling in that month, the green trees and shrubs or flowers, and the resident birds. As many of the technical features of a car as will be understood by the average user of electrical vehicles are described. The year book is a distinctive addition to catalog literature and cannot fail to make a direct appeal to those for whom it was intended, the women as well as the men buyers and users of electric pleasure vehicles.

Business Notes

GENERAL VEHICLE COMPANY.—The Manila agent of the General Vehicle Company has secured orders for eight light wagons and one 2-ton truck. With these orders, the total of commercial cars of General Vehicle make in use in or on order for the Philippines is brought up to thirty-two.

THE WARREN ELECTRIC COMPANY, electrical contractor and dealer in electrical supplies, Trinidad, Col., was recently reorganized, and the following officers were elected: President, Mr. J. A. Dalby; manager, Mr. H. W. Reaume; secretary and treasurer, Mr. W. D. Warren. Mr. Reaume will have charge of the electrical department, while the office affairs and purchasing will be in the hands of Mr. Warren, who was with the old firm for ten years and has had considerable experience in the general electrical construction and supply business.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 12, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,043,799. MOTOR-CONTROL SYSTEM; J. E. Brobst, Schenectady, N. Y. App. filed April 24, 1912. Reversible motors for starting and stopping of planers, printing presses, etc.

1,043,802. FUSE ATTACHMENT; C. Carson, Dayton, Ohio. App. filed Oct. 5, 1910. Swivel attachment for lamp sockets.

1,043,810. JACK; A. F. Dixon and W. E. Freeman, East Orange, N. J. App. filed April 5, 1911. Mounting plate for springs, fuses and protectors.

1,043,818. NON-INTERFERENCE SIGNAL BOX; G. L. Foote, Brooklyn, N. Y. App. filed Feb. 1, 1911. Automatic lock-out and release.

1,043,821. ELECTRIC LIGHT; A. W. Gast, Chicago, Ill. App. filed March 16, 1911. A sign light with a number of small filaments in an exhausted tube.

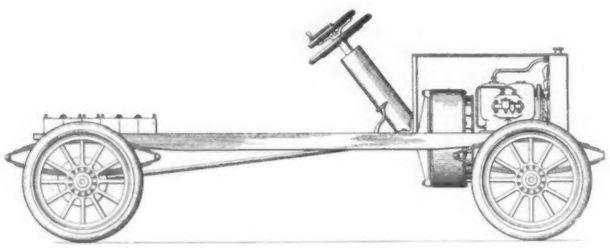
1,043,823. PLUG; D. D. Gordon, Chicago, Ill. App. filed April 1, 1911. Segmental screw threads and clamps for socket connection.

1,043,859. ELECTRIC SWITCH; J. W. Morway, Plainville, Conn. App. filed June 9, 1911. Block type of rotary snap switch.

1,043,864. ELECTRICALLY HEATED SADIRON; E. L. Pollard (deceased), Dobbs Ferry, N. Y. App. filed Oct. 26, 1911. Hinged cover and feeder; cable clamp.

1,043,865. TELEGRAPH APPARATUS; E. Pope, Quebec, Canada. App. filed June 25, 1910. Printing apparatus. (Sixty-two claims.)

1,043,879. TROLLEY; E. A. Sullivan, Toronto, Canada. App. filed May 1, 1909. Pivotally mounted head.



1,044,409.—Power Installation.

1,043,887. DYNAMO-ELECTRIC MACHINE; J. B. Wiard, Lynn, Mass. App. filed Dec. 6, 1905. Self-ventilating fan blades on the conductor bars.

1,043,906. POLE CHANGER; W. W. Dean, Elyria, Ohio. App. filed Dec. 27, 1910. Harmonic party-line signaling.

1,043,916. INSULATOR; F. M. Farwell, Kansas City, Mo. App. filed Oct. 17, 1911. Two-party line wire insulator.

1,043,917. ELECTRIC CLOCK; C. Fery, Paris, France. App. filed Feb. 25, 1911. Electromagnetic pendulum impulse.

1,043,923. STRENGTHENING ELECTRIC ALTERNATING CURRENTS; R. Goldschmidt, Darmstadt, Germany. App. filed April 6, 1911. Long-distance telephone and telegraph.

1,043,937. ANODE AND PROCESS OF MANUFACTURING THE SAME; M. Huth, Charlottenburg, Germany. App. filed Nov. 22, 1910. Crystalline peroxide of manganese with embedded lead peroxide.

1,043,942. NO-VOLTAGE RELEASE MECHANISM; A. Kimble, Chicago, Ill. App. filed March 18, 1912. Detent shoulders and guard members.

1,043,961. TROLLEY WHEEL; G. F. Murch, New York, N. Y. App. filed Dec. 7, 1910. Anti-friction bearings.

1,043,963. SOLDERING IRON; J. L. Nillson, Chicago, Ill. App. filed June 6, 1910. Interchangeable resistance coils.

1,043,975. FIRE-ALARM SIGNALING APPARATUS; J. V. Shier, Sr., and J. La Vergne, Sr., Charleston, S. C. App. filed April 12, 1912. Visual and audible signal attachment.

1,043,994. TROLLEY-WHEEL GUARD; C. G. and V. R. Wittmann, Independence, Mo. App. filed Feb. 27, 1911. Jointed pole head.

1,044,021. ELECTRIC INDICATING DEVICE FOR SIGNALS; G. A. Clingwald, Edison, Cal. App. filed April 14, 1910. Pointer-controlled indicator.

1,044,088. ELECTRIC FURNACE; T. P. Sharts, North Adams, Mass. App. filed March 14, 1912. A stationary electrode and laterally adjustable inclined electrodes.

1,044,099. DOOR-BOLT-ACTUATED CIRCUIT-CLOSER; G. A. Spring, Columbus, Ohio. App. filed April 6, 1910. Emergency exit lock.

1,044,108. CONDUIT FOR HIGH-TENSION ELECTRIC CURRENTS; W. A. Warren, Hurley, N. Y. App. filed April 19, 1905. The wire is immersed in oil in the conduit.

1,044,117. TELEPHONE RECEIVER; C. Adams-Randall, Boston, Mass. App. filed Feb. 28, 1912. Adjustable permanent magnet.

1,044,148. TROLLEY BASE; C. O. Dawson and R. Gooding, Rochester, Mich. App. filed Oct. 20, 1910. Automatic pole latch.

1,044,151. CONTROLLING APPARATUS FOR CAB STANDS; T. Drost, Hamburg, Germany. App. filed Jan. 19, 1912. Check-controlled indicating mechanism.

1,044,156. CEMENT FOR METALLIC FILAMENTS; K. Farkas, New York, N. Y. App. filed Aug. 11, 1909. Powdered tungstens, oxides, metallic aluminum and sodium silicate.

1,044,158. TROLLEY WHEEL; A. H. Fetzer, Galion, Ohio. App. filed Jan. 27, 1911. Anti-friction bearing and universal joint.

1,044,189. CABLE TELEGRAPHY; I. Kitsie, Philadelphia, Pa. App. filed Nov. 14, 1907. A relay having a zero position.

1,044,192. PLUG OR LAMP RECEPTACLE; H. F. Krantz, New York, N. Y. App. filed July 22, 1911. Terminal connections.

1,044,201. PROCESS OF PRESERVING; J. C. Lincoln, Cleveland, Ohio, App. filed Sept. 27, 1909. Electric curing in a magnetic field.

1,044,212. CONTROLLER REGULATOR; F. P. Maize, Portland, Ore. App. filed June 3, 1912. For railway cars; controller arm, delayed action.

1,044,217. SQUIRREL-CAGE ROTOR; B. McCollum, Washington, D. C. App. filed Dec. 6, 1911. A resistance element of small cross-section and positive temperature coefficient is inserted in each of the conductor bars.

1,044,218. ELECTRICAL SIGNAL TRANSMITTER; J. McFell, Chicago, Ill. App. filed April 9, 1910. For transmitting code signals.

1,044,228. SAFETY CHEST; L. Myers, Newark, N. J. App. filed Dec. 11, 1907. Burglar alarm for jewel casket.

1,044,229. AUTOMATIC TELEPHONE SYSTEM; E. Neuhold, Friedenau, Germany. App. filed Oct. 8, 1910. Speaking connections are released by hanging up the receiver.

1,044,249. WIRE COUPLING; J. P. R. Ronfet, Paris, France. App. filed May 2, 1912. Slotted block with wedge.

1,044,269. ELECTRICAL HEATING UNIT; C. A. Shaler, Waupun, Wis. App. filed Feb. 28, 1910. The flow of current is automatically controlled.

1,044,270. ELECTRICAL HEATING PAD; C. A. Shaler, Waupun, Wis. App. filed Feb. 28, 1910. Automatic heat control within limits established by manual regulation.

1,044,284. HEATING DEVICE; W. Stanley, Great Barrington, Mass. App. filed April 29, 1912. Heat-storage device for cooking, etc.

1,044,291. ELECTRIC LIGHTING; F. L. Temple, Cedar Grove, N. J. App. filed Aug. 28, 1911. Socket switch control.

1,044,293. TROLLEY WHEEL; L. J. Tetlow, West Springfield, Mass. App. filed Aug. 16, 1911. Malleable iron with brass running face.

1,044,295. PROCESS OF PRODUCING SILICON CARBIDE; F. J. Tone, Niagara Falls, N. Y. App. filed June 14, 1907. Solid carbon core.

1,044,296. METHOD OF MANUFACTURING CRYSTALLINE ALUMINA; F. J. Tone, Niagara Falls, N. Y. App. filed Aug. 30, 1911. Pure amorphous alumina is melted with easily reducible metalliferous oxides.

1,044,298. TROLLEY; A. Trible, Wilmerding, Pa. App. filed Feb. 23, 1912. Shifting mechanism.

1,044,378. REVOLVING CONTACT SWITCH; E. J. Guay, Lynn, Mass. App. filed July 20, 1910. Periodic rotation.

1,044,399. IGNITION SYSTEM; S. L. Lebby, James Island, S. C. App. filed Feb. 27, 1911. Combined ignition and lighting system for motorboats and vehicles.

1,044,409. POWER INSTALLATION; W. Morrison, Chicago, Ill. App. filed Feb. 3, 1908. For propelling motor vehicles; gas engine drives a motor generator.

1,044,411. SIGNALING APPARATUS; C. P. Nachod, Philadelphia, Pa. App. filed Oct. 13, 1908. Railway-block visual signal.